

# **California Water Service Company**

## **Skyline and Old La Honda Systems**

### **Water Supply and Facilities Master Plan**

**(Addendum to the Bear Gulch District  
Water Supply and Facilities Master Plan)**

## **Final Report**

**2018**

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## Executive Summary

California Water Service (Cal Water) prepares Water Supply and Facility Master Plans (WS&FMP) for each of its districts every ten years per California Public Utility Commission (CPUC) requirements. These documents provide internal and external stakeholders with an assessment of existing infrastructure and general high-level direction on potential mid- and long-term infrastructure needs to (1) ensure that Cal Water maintains and improves its long-term operational reliability and (2) has a sufficient technical basis to support subsequent General Rate Case (GRC) project justifications.

WS&FMPs focus on the “critical facilities,” of each system, which include wells, booster/pump stations, water mains, storage tanks, and water treatment facilities. The plans incorporate Cal Water’s supply reliability analysis and ongoing infrastructure assessments to identify (1) current and anticipated infrastructure deficiencies and associated risks and (2) the approximate timing and type of potential improvements necessary to maintain and improve Cal Water’s long-term operational reliability.

The 2008 Bear Gulch WS&FMP was completed prior to acquisition of the Skyline and Old La Honda Systems. This document, the Skyline and Old La Honda Systems WS&FMP, is an addendum to the Bear Gulch WS&FMP. The Bear Gulch WS&FMP is scheduled to be updated in 2021, which will provide a more comprehensive analysis of the entire districts long-term needs and the impacts of the integration of the Skyline, Old La Honda, and possibly other systems into the Bear Gulch District.

Key findings from the review of the Skyline and Old Woodside systems are summarized below.

### **System Demands**

- **Service Growth and Projected Demands**
  - Increases in projected demands under the full buildout scenarios for both systems are limited due to the restrictions on future development.
  - No developments have been proposed nor have any will serve letters been issued for these areas.
  - To account for possible unanticipated future growth in Skyline System, 4 to 5 single family services are assumed to be added every five years until 2040. The remaining customer classes are assumed to be constant until 2040. This assumed service growth will increase the current 475 active services to 495 active services.
  - Zero service growth was assumed for the Old La Honda System until 2040.
  - The future demand for Skyline System for 2040 is 66,451 kGals (0.182 MGD), an increase of 17% from 2017 existing demand.
  - The Old La Honda System is expected to remain constant at 5,971 kGals (0.016 MGD) until 2040.

### **System Capacity**

- **Connection Capacity**
  - The sole supply for the Skyline System is a SFPUC turnout at Station 40. The capacity is sufficient to meet Average Day and Maximum Day Demands for the Skyline System. To meet the Peak

Hour Demand of the system, additional storage needs to be developed (see Storage Capacity discussion below).

- The Old La Honda System is supplied from Station 45 (Bear Gulch Zone 1025). The current capacity of Station 45 is sufficient to meet Average Day, Maximum Day, and Peak Hour Demands.
- **Storage Capacity**
  - A storage capacity analysis was performed for both systems to assess operational, emergency, and fire storage requirements.
  - The Skyline System has an estimated storage deficit of 0.45 MG. The proposed development of storage tanks (0.26 MG total) at Station 48, which is included in the 2018 General Rate Case will help reduce the storage deficit, but additional storage is still needed for this system to meet Cal Water's storage requirement criteria.
  - The storage capacity analysis for the Old La Honda System has found to have sufficient storage.
- **Pump Capacity - Gap (Zone) Analysis**
  - A pump capacity analysis was performed for Operational, Emergency, and Fire conditions in for both systems.
  - *Skyline System*
    - The calculation shows that for a total system analysis, there is sufficient pump and storage capacity to meet existing demand, using the maximum demand from the last ten years.
    - Zone 2370 zones has sufficient pump and storage capacity without consideration of the flow go to Zone 1610 and cascading zones.
    - Zone 1610 and the cascading zones has a storage deficiency under fire flow and emergency conditions. The calculation shows a deficiency of 60,000 gals for fire flow conditions and 82,000 gals for emergency conditions, for a total of 142,000 gallon deficit. The proposed storage tank at Station 48 will be located at Zone 2370, which is a higher pressure zone and may provide a cascade flow to Zone 1610. This will reduce the storage deficit requirement for this zone.
    - A siting study to determine the development of supplemental storage at Zone 1610 is recommended.
  - *Old La Honda System*
    - The calculation shows that for a total system analysis, there is sufficient pump and storage capacity to meet the existing maximum demand, based on the maximum demand for the last ten years.
    - For both Zones 1255 and 1810, the analysis shows a deficiency under fire flow conditions. For Zone 1255, there is a deficiency of 46,000 gals while there is a deficiency of 19,000 gals for Zone 1810. Additional analysis is recommended to better determine the storage deficiency amount and investigate available options.

### **Asset Management**

- **Main Replacement Program**
  - The program has identified several candidate pipeline project for future GRC and no proposed project for the current GRC.
- **Tank Maintenance Program**
  - All of the tanks for both system have been replaced recently and no tank retrofit or coating projects are required at this time.

**Capital Planning****• Current Capital Projects**

- Projects for the current 2018 GRC include:
  - Acquisition of property and construction of water storage tanks with a capacity of 0.26 MG
  - Pipeline project that connects Zone 1810 (Old La Honda System) and Zone 1610 (Skyline System) with a new main.
  - Pipeline project to install a new 8-inch transmission line from Station 32 Wayside Tank to Station 46 Orchard Hill
  - Two pump replacement projects for pump and motor replacements at Station 043 are included in the current GRC.

**• Future Projects**

- Recommended future projects for the Skyline and Old La Honda Systems include the following:
  - Bear Gulch Master Plan Update
  - Edmonds Lift Study
  - Edmonds Lift Transient Analysis
  - Skyline Trunkline Inspection
  - Station 044 Well to Skylonda Project
  - Well Siting Study
  - North Skyline System Storage
  - Station 42 to 41 Reverse Flow Study
  - Dead End Mains Study
  - Low Pressure Analysis



## 1. Preface

California Water Service (Cal Water) prepares Water Supply and Facility Master Plans (WS&FMP) for each of its districts every ten years per California Public Utility Commission (CPUC) requirements. These documents provide internal and external stakeholders with an assessment of existing infrastructure and general direction on potential mid- and long-term infrastructure needs to (1) ensure that Cal Water maintains and improves its long-term operational reliability and (2) has a sufficient technical basis to support subsequent General Rate Case (GRC) project justifications.

WS&FMPs focus on the “critical facilities,” of each system, which include wells, booster/pump stations, water mains, storage tanks, and water treatment facilities. The plans incorporate Cal Water’s supply reliability analysis and ongoing infrastructure assessments to identify (1) current and anticipated infrastructure deficiencies and associated risks and (2) the approximate timing and type of potential improvements necessary to maintain and improve Cal Water’s long-term operational reliability.

The WS&FMPs are developed by compiling and incorporating information from the following internal sources:

Cal Water Programs/Teams	Subject Matter
Operations/District Management	District operations/insight
Mainline Replacement Program	Listing of level of concern risk factors for all mains
Well Replacement Program	Listing of unadjusted life expectancy of each well
	Critical list of wells
Tank Infrastructure	Tank maintenance
New Business Development	Provide recommended upsizing of mains due to development
	GIS map of major housing developments
	Water Supply Assessment (WSA)
Operations/Modeling	Hydraulic Model/Status
Water Quality	Trending of contaminants
Water Conservation	Conservation Master Plan
	Sales Report
Capital Planning/Engineering Design	Provide information on the most recent Capital Improvement Project list and 10-year plan
	Provide critical facilities listing
Water Resources and Planning	Historical service, sales, and production
	GRC Supply Demand Analysis (Gap Analysis)
	Overall Supply Recommendations



## 2. District Background

This section describes the location, characteristics, and future land uses, and development of Skyline and Old La Honda Systems of Cal Water's Bear Gulch District.

### 2.1 Location of Systems

Cal Water acquired the Skyline County Water District in 2009 and operated the Woodside Mutual Water Company (referred to as the Old La Honda system in this document) in 2008, then acquired it in 2009. Both systems have been incorporated into Cal Water's Bear Gulch District (District) in San Mateo County. The acquisition and incorporation of the Skyline and Old La Honda Systems occurred after completion of the last Bear Gulch District WS&FMP in 2008. The Bear Gulch WS&FMP is scheduled to be updated in 2021, which will provide a more comprehensive analysis of the entire districts long-term needs and the impacts of the integration of the Skyline, Old Woodside, and possibly other systems into the Bear Gulch District.

The Bear Gulch District is one of the Cal Water Districts on the San Francisco Peninsula (see Figure 2-1) and serves Atherton, portions of Menlo Park, Portola Valley, Old La Honda, and areas of unincorporated areas of San Mateo County (North Fair Oaks, Menlo Oaks, Sequoia Tract, West Menlo Park, Weekend Acres, Ladera, Los Trancos Woods, and Vista Verde). Cal Water has provided water service to the Bear Gulch area since 1933.

Figure 2-1: Location of the Peninsula Districts

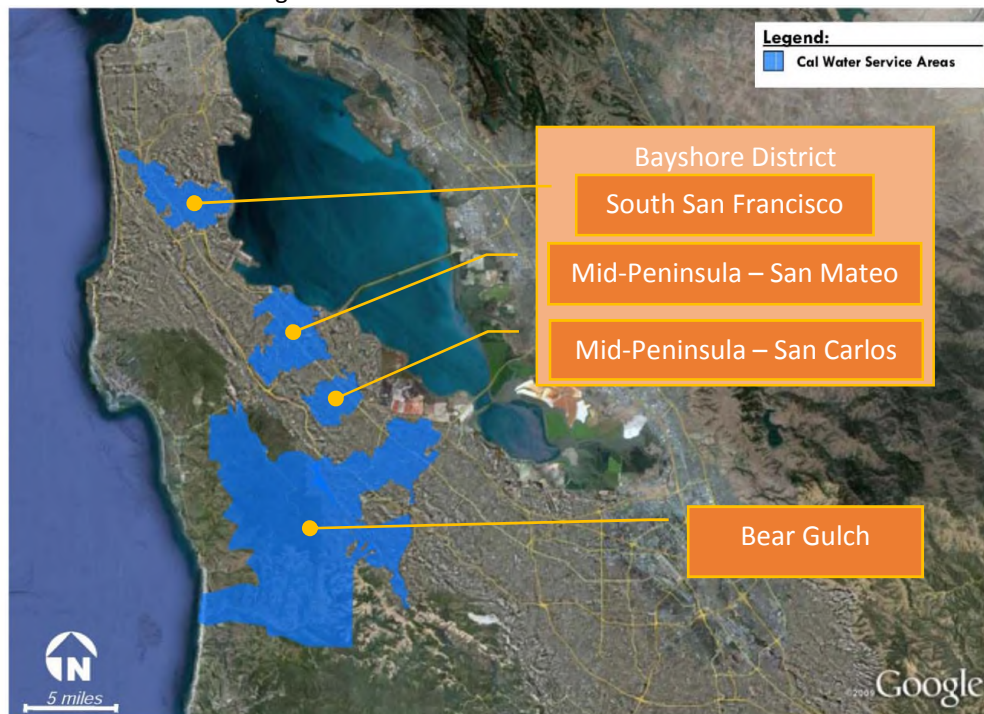
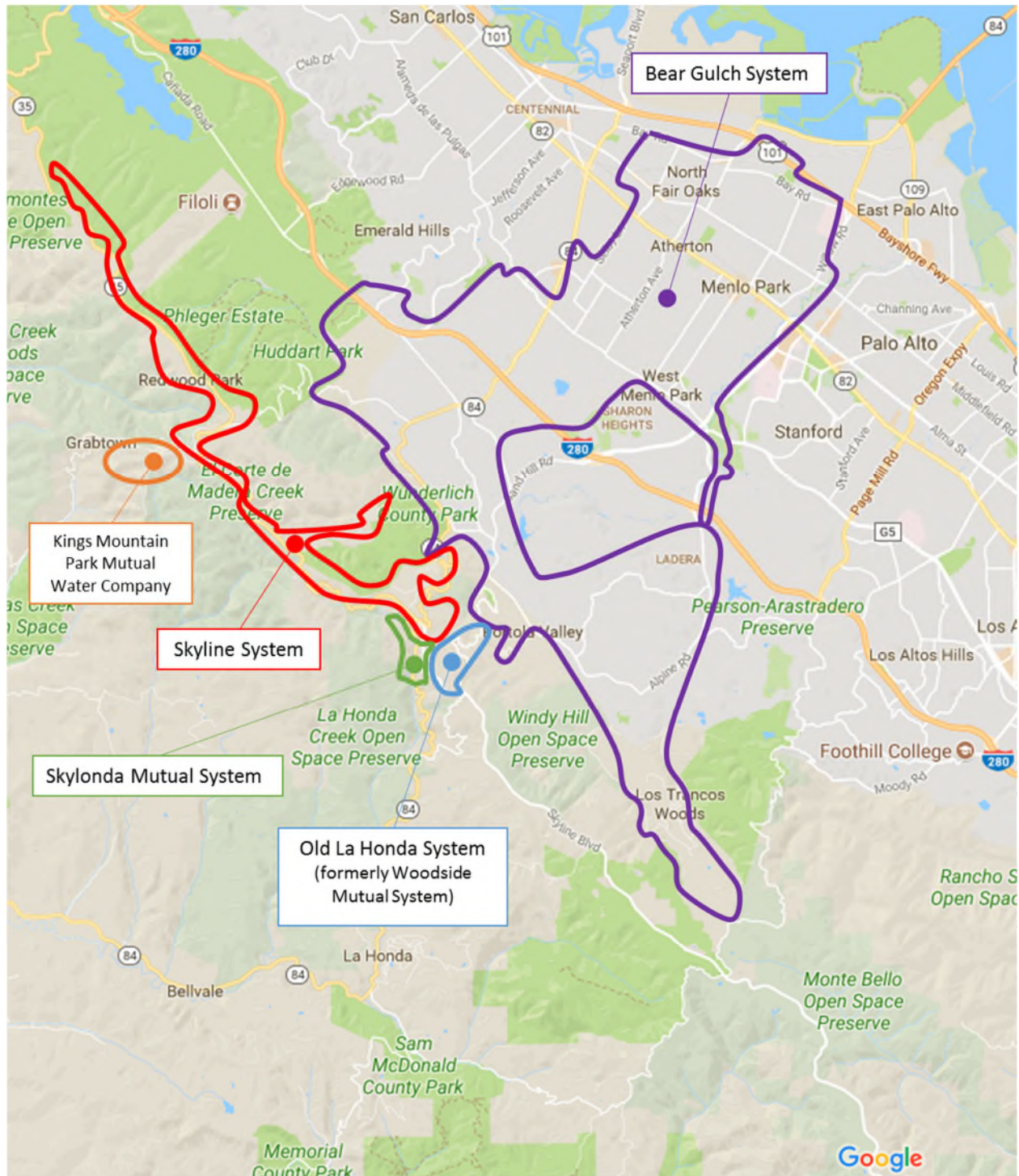


Figure 2-2 also shows the Skylonda Mutual Water System, which is adjacent to both Skyline and Old La Honda Systems. Cal Water is currently in negotiations to purchase the Skylonda Mutual Water System.

If this system is acquired, many benefits would become available, such as a possible connection between the Skyline System and Old La Honda System, and additional water rights, surface treatment capacity, and supply reliability. A map of the systems in the Bear Gulch District with the general locations of Old La Honda, Skyline, and Skylonda is shown in Figure 2-2.

Figure 2-2: General Location of Bear Gulch District



An additional adjacent water system is the Kings Mountain Park Mutual Water Company (KMPMWC). KMPMWC is classified as a community water system and is regulated by the Division of Drinking Water (DDW). It is located along Highway 35, east of Purisima Creek Redwoods Open Space Preserve. It serves a population of approximately 66 via 23 service connections. KMPMWC previously served King's Mountain Elementary School, but as of 2008, service at the school was provided by Skyline County Water District (now Cal Water's Skyline System).

## 2.2 History of District Formation

Appendix A1 shows a system plan view schematic of the entire Bear Gulch District as a reference to show how Skyline System and Old La Honda Systems are incorporated into the District.

### Skyline System

Skyline County Water District (SCWD) was established in 1953 to serve mainly residential homes along Skyline Drive in the San Mateo County area. Originally, the source of supply was one well (Skywood well) and purchased water from San Francisco Public Utilities Commission (SFPUC). Eventually, the well was taken offline due to well failure and water quality problems and the SFPUC supply became the sole source of supply for the system.

The system is located near the communities of Woodside and Portola Valley. Skyline currently serves approximately 475 metered service connections throughout a 17 square mile service area. The Skyline service area is in mountainous terrain, heavily forested, with elevations ranging from approximately 300 feet to 2,350 feet mean sea level (MSL). The distribution system consists of 6, 4 and 2 inch diameter pipeline of material including welded steel, galvanized steel, ductile iron, PVC and asbestos-cement. The system includes multiple pressure zones. Each zone is separated from higher pressure zones by means of a pressure reducing valve. The District presently has four storage tanks, two located at the Skyline Drive site and the remaining two tanks located in the Skywood area. A schematic of the District's facilities is shown in Appendix A2.

The backbone of the distribution system is a mainline which traverses approximately 8½ miles along Skyline Boulevard. It has sufficient volume and pressure at the different service connections during average and maximum day domestic use. However, during fire flows or emergency situations, such as power outages, fires, or broken water mains, the District has reportedly experienced shortages in supply or low pressure in the distribution system. Fortunately, to date, the SFPUC supply source has been restored in time for the District to pump more than its daily demand in re-establishing safe water levels in the storage tanks. However, during fire flow testing, several portions of the distribution system have been observed to be at less-than atmospheric pressure, which can result in the collapsing of mainlines and allow contaminants to enter the water distribution system.

### Old La Honda System

Prior to Cal Water's acquisition of the Old La Honda Mutual Water Company (WMWC), the system was operated by the county and was designated as County Service Area No. 7, La Honda Water System. Records of the system prior to the acquisition have not been properly maintained. Partial records shows this system as being established in the late 1960's, while some parts of the distribution system have been dated from the 1920's.

The Old La Honda System is located in the Woodside Hills on the Pacific coast side of San Mateo County along La Honda Creek and Alpine Creek. The connection with the Bear Gulch District starts on Wayside

near Station 45 at approximately 950 feet elevation to Station 47 at approximately 1800 feet elevation. A schematic of the District's facilities is shown in Appendix A3.

The system is comprised of 45 property owners with an average property value of over \$2 million. The original water system supplied these homes consisting of mainly 2-inch steel pipes, which were showing visible signs of deterioration resulting in frequent repairs. There was also concern that these pipes may experience catastrophic failure over the next few years. The majority of the pipes were located in highly vegetated, steep, cross country terrain, making accessibility for repairs extremely difficult.

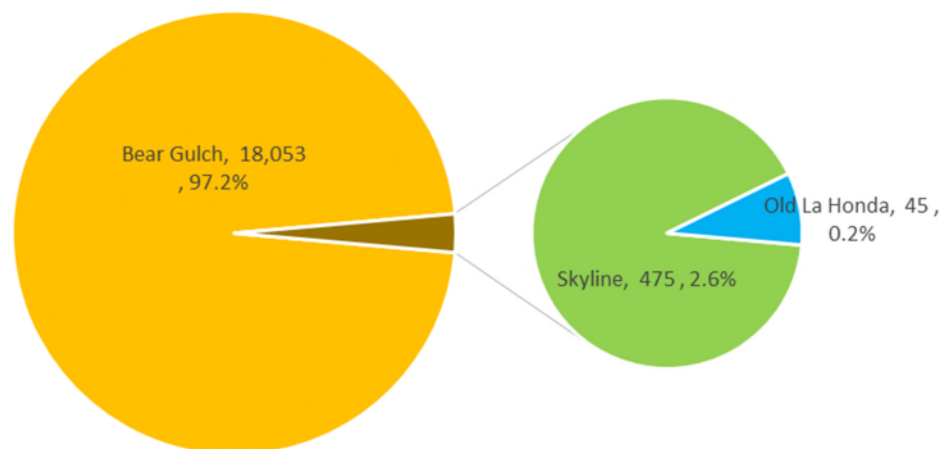
Prior to the acquisition, WMWC retained Pakpour Consulting Group to develop a water system master plan, which consisted of mapping the existing distribution system and developing several design alternatives to completely upgrade the system. The proposed system included new 6 to 8-inch water mains, fire hydrants, pumps and storage facilities. Cal Water has been diligently pursuing replacement of facilities as described in the plan.

### 2.3 Historical and Present Customer Services

Information on historical service growth and the demand per service for the two systems was based on historical customer data from 2008 through 2017. Appendix B summarizes the historical record of active services for the Skyline (B1) and Old La Honda (B2) Systems, along with the Bear Gulch System (B3) and District (B4) totals.

The relative size of the Skyline and Old La Honda Systems in relation to the Bear Gulch System is shown in the following figure. As shown, the total number of services in both the subject systems account for less than 3% of the total accounts for the Bear Gulch District.

Figure 2-3: Relation of Total Active Accounts



Skyline System

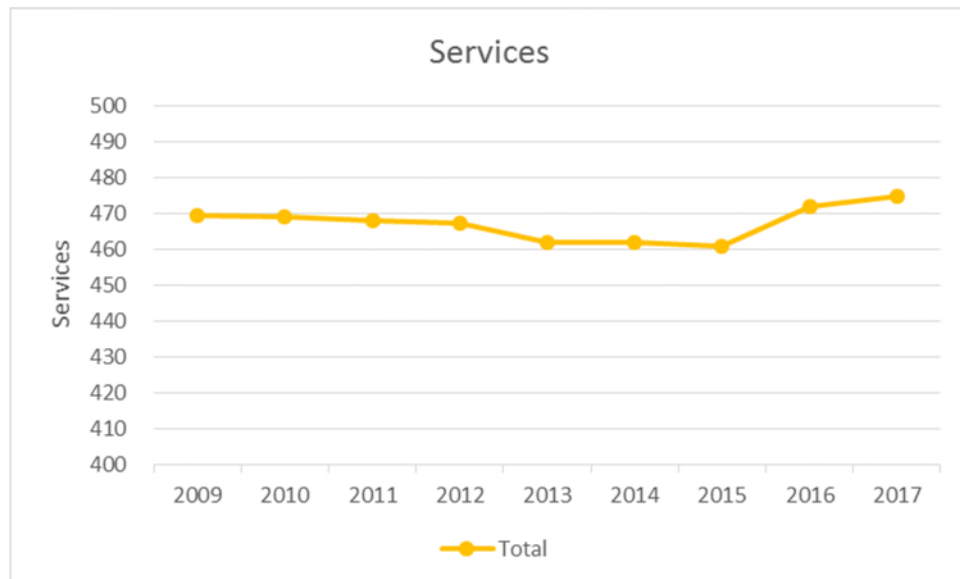
The current (2017) service count for the Skyline System is summarized as follows:

Table 2-1: Skyline System Active Services (2017)

Single Family Res.	456
Multi-Family Res.	1
Commercial	11
Irrigation	1
Other	4
Public Authorities	2
Total	475

Growth has been slow within the Skyline System, consisting primarily of the addition or redevelopment of single-family residences. The number of residential service connections in 1985 was 434 based on Skyline County Water District records. When Cal Water acquired the system in 2009, the single-family residences totaled 457, with total of 470 active accounts. The total service account stayed relatively the same until 2012, at which point all service records were merged with the Bear Gulch District. Estimates of the service accounts from 2013 to the present is based on a database download and GIS geolocation of the active services. This method is not completely accurate, but provides an adequate estimate to base the number of active accounts. In 2017, the single-family residences remained about the same at 456 and the total customer service count increased to 475. This single family service increase is attributed to a new development of single family homes around Manzanita Rd., Filbert Rd., Creek Trail, Huckleberry Trail and Fern Trail.

Figure 2-4: Skyline System Total Active Services



### Old La Honda System

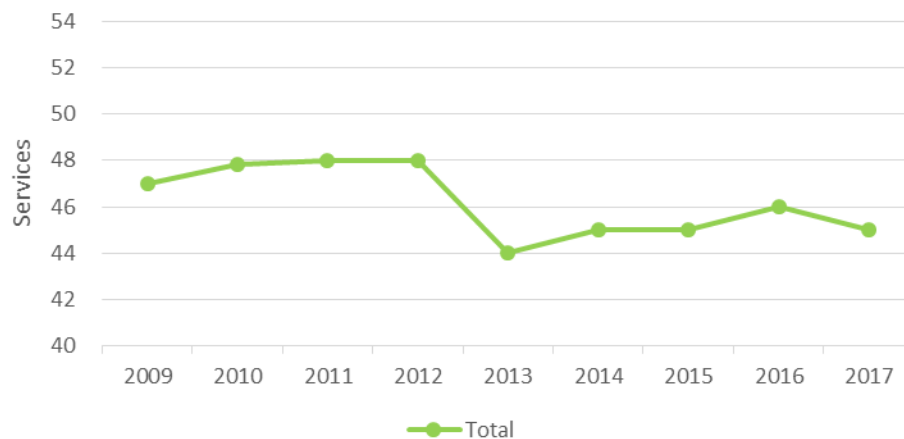
The current (2017) service count for the Old La Honda System is summarized as follows:

Table 2-2: Old La Honda System Active Services (2017)

Single Family Res.	44
Multi-Family Res.	1
Total	45

When Cal Water acquired the Old La Honda System in 2008 the system had 46 active services based on Cal Water Billing Register records. It is assumed that the number of services was constant prior to the acquisition. The Billing Register database maintained the service accounts for Old La Honda from 2008 to 2012, at which point all of the information was incorporated with the Bear Gulch District. Similar to the Skyline discussion above, using GIS geolocation, it was found that the service counts remain relatively constant since the last recorded value in the Billing Register. The area served by the Old La Honda System is considered built-out since there are no vacant properties for development within the service area. The possibility does exist for potential subdivisions of properties or the addition of nearby home with private wells to be connected to the La Honda system.

Figure 2-5: Old La Honda System Total Active Services



## 2.4 Water Supply Assessments, Will Serve Letters, Ordinances, and Land Use Scenarios

The following is a description of the initial documentation that would be necessary to start the process of developing any new construction of housing or businesses.

Water Supply Assessments (WSA's) are defined under Senate Bills 610 (Chapter 643, Statutes of 2001) (SB 610) and Senate Bill 221 (Chapter 642, Statutes of 2001) (SB 221) amended state law, effective January 1, 2002, to improve the link between information on water supply availability and land use development decisions made by cities and counties. SB 610/SB 221 are companion measures that require detailed information regarding water supply availability be provided to local public agency decision-makers prior to approval of development projects that meet or exceed any of the following criteria:

1. A residential development of more than 500 dwelling units.
2. A shopping center or business establishment employing more than 1,000 persons or

- having more than 500,000 square feet.
3. A commercial office building employing more than 1,000 persons or having more than 250,000 square feet of floor space.
  4. A hotel or motel with more than 500 rooms.
  5. An industrial, manufacturing or processing plant or industrial park planned to house more than 1,000 persons occupying more than 40 acres of land or having more than 650,000 square feet of floor area.
  6. A mixed-used project that includes one or more of the projects specified above.
  7. A project that would demand an amount of water equivalent to, or greater than the amount of water required by a 500 dwelling unit project.

A Will Serve letter is issued by a water utility outlining the conditions of water service to a particular parcel. It is also the District's conditional commitment to serve new customers. A will serve letter is required by the county and city to ensure that sufficient capacity is available to serve new construction.

The San Mateo County General Plan (1986) outlines a Conservation and Open Space Element which designates land use elements; however, most of these designations have been superseded by the Local Coastal Program and the Skyline Area General Plan Amendment.

The Midpeninsula Regional Open Space District is a California special district, a form of local government created by a community to meet a specific need. The District was founded in 1972 to preserve the regional greenbelt in northwestern Santa Clara County. The voters expanded the District in 1976 to include southern San Mateo County and again in 1992, to add a small portion of Santa Cruz County. In 2004, through the Coastsides Protection Program, the District's boundary was extended to the Pacific Ocean in San Mateo County. El Corte De Madera Creek Open Space Preserve borders the western border of the Skyline System. Due to open space requirements, very little to no significant developments will likely occur in these areas.

Cal Water's Distribution Group utilizes Distribution Planning Growth App, an ArcGIS Online application, to identify potential growth areas based on WSA reports completed by Cal Water, as well as new development projects received by Cal Water districts for the design of facilities, such as main extension, to serve the development. This map will capture the general location of the development. In addition, for projects where Cal Water has completed the design, the app will be linked to Cal Water's New Business design database that has information such as number of services, developer's name, design drawing, etc.

At the time of development of this Plan, no WSA or Will Serve letters have been issued. Any remaining land has been found to be undevelopable or thought to be part of open space region and thus not available for development. The county has subdivided some areas into parcels, but no developments have been proposed nor have any will serve letters been issued for this area.

## 2.5 Projected Customer Services

### Skyline System

Projected service growth for this area is very limited. In early 2018, an internet search of this area only found two vacant properties. In addition, most of the region has high slopes which will not be suitable for any development. The San Mateo County designated this area as rural subdivisions with sparsely populated areas zoned for single family use and subdivided into small lots in the rural portions of the

County. They are located in an area generally west of Skyline Boulevard. Historically, these areas were developed for use as vacation homes, however, as access routes improved, these areas were developed for year-round living. To account for any new services that may be developed, 4 to 5 single family services are assumed to be added to the Skyline System for every five years until 2040. The remaining customer classes are assumed to be flat until 2040. The services projected are summarized in Table 2-3 for 2020-2040.

Table 2-3: Projected Services for Skyline System

	<b>2017 (existing)</b>	<b>2020</b>	<b>2025</b>	<b>2030</b>	<b>2035</b>	<b>2040</b>
Single Family Res.	456	458	462	467	471	476
Multi-Family Res.	1	1	1	1	1	1
Commercial	11	11	11	11	11	11
Irrigation	1	1	1	1	1	1
Other	4	4	4	4	4	4
Public Authorities	2	2	2	2	2	2
Total	475	477	481	486	490	495

### Old La Honda System

Old La Honda System can be assumed to have zero growth for the term of this Master Plan, as summarized in Table 2-4 for 2020-2040.

Table 2-4: Current and Projected Services for Old La Honda System

	<b>2017 (existing)</b>	<b>2020</b>	<b>2025</b>	<b>2030</b>	<b>2035</b>	<b>2040</b>
Single Family Res.	44	44	44	44	44	44
Multi-Family Res.	1	1	1	1	1	1
Total	45	45	45	45	45	45

## 2.6 Population Estimate

MARPLOT® is the mapping program for the CAMEO® software suite, which is used widely to plan for and respond to emergencies. MARPLOT's easy-to-use GIS interface allows one to add objects to a map, as well as view and edit data associated with the objects. The software has an interactive feature to determine population estimates within an area. Cal Water utilizes this feature to get 2010 US Census data based on service areas that do not align with city boundaries.

For the Skyline System, a density of 2.16 persons per dwelling unit is estimated. For the Old La Honda System, a density of 2.15 persons per dwelling unit is estimated. At the time of this report development, there is no indication of any change in these densities. As a comparison, the Bear Gulch District has a density of 2.59 persons per dwelling unit.

Both systems have one active account for multi-family residential category. It is assumed that this account is for a duplex, thus two dwelling units would be associated with this customer account.

The current and projected estimate for the two systems is summarized in the following table.

Table 2-5: Current and Projected Population

	<b>2017</b>	<b>2020</b>	<b>2025</b>	<b>2030</b>	<b>2035</b>	<b>2040</b>
Skyline System	989	993	1,003	1,013	1,023	1,032
Old La Honda System	99	99	99	99	99	99
Total	1,088	1,092	1,102	1,112	1,122	1,131

## 2.7 Reference Documents

The following reference documents are associated with Skyline and Old La Honda Systems:

- Bear Gulch District Water Supply and Facilities Master Plan completed in 2008
- Mid-Peninsula Water Supply and Facilities Master Plan completed in 2008
- South San Francisco Water Supply and Facilities Master Plan completed in 2006
- Integrated Long-Term Water Supply Plan for Cal Water's Peninsula Districts completed in 2011
- Conservation Master Plan completed in 2016

As discussed above, this document will focus on the two water systems that have been incorporated into the Bear Gulch District since the publication of the Bear Gulch District WS&FMP completed in 2008. The existing master plan will be updated in 2021. Since all of the Peninsula Districts have a common water source, the master plans for Mid-Peninsula and South San Francisco will be updated in 2021 as well.



### 3. Existing Water System

This section provides a summary description of the Skyline and Old La Honda existing water system configurations and facilities.

#### 3.1 General Description

##### Skyline System

The source of supply for the Skyline System is a single SFPUC connection located on Edmonds Road. These supplies are transferred to the System's 2370 zone by a single high pressure lift station (discharge pressure above 1100 psi), Station 40, via a 6.3 mile plastic-coated welded steel pipeline that traverses the SFPUC watershed. One customer is connected to the pipeline (Phleger Property) and only receives supply when the pump station is operating.

With the exception of the 2450 zone, all of the zones are gravity fed from the 2370 zone in 3 cascades, 1 located to the north and 2 in the south, through a series of pressure reducing valves. Additional storage is located at Station 42 (Skywood Tanks.)

##### Old La Honda System

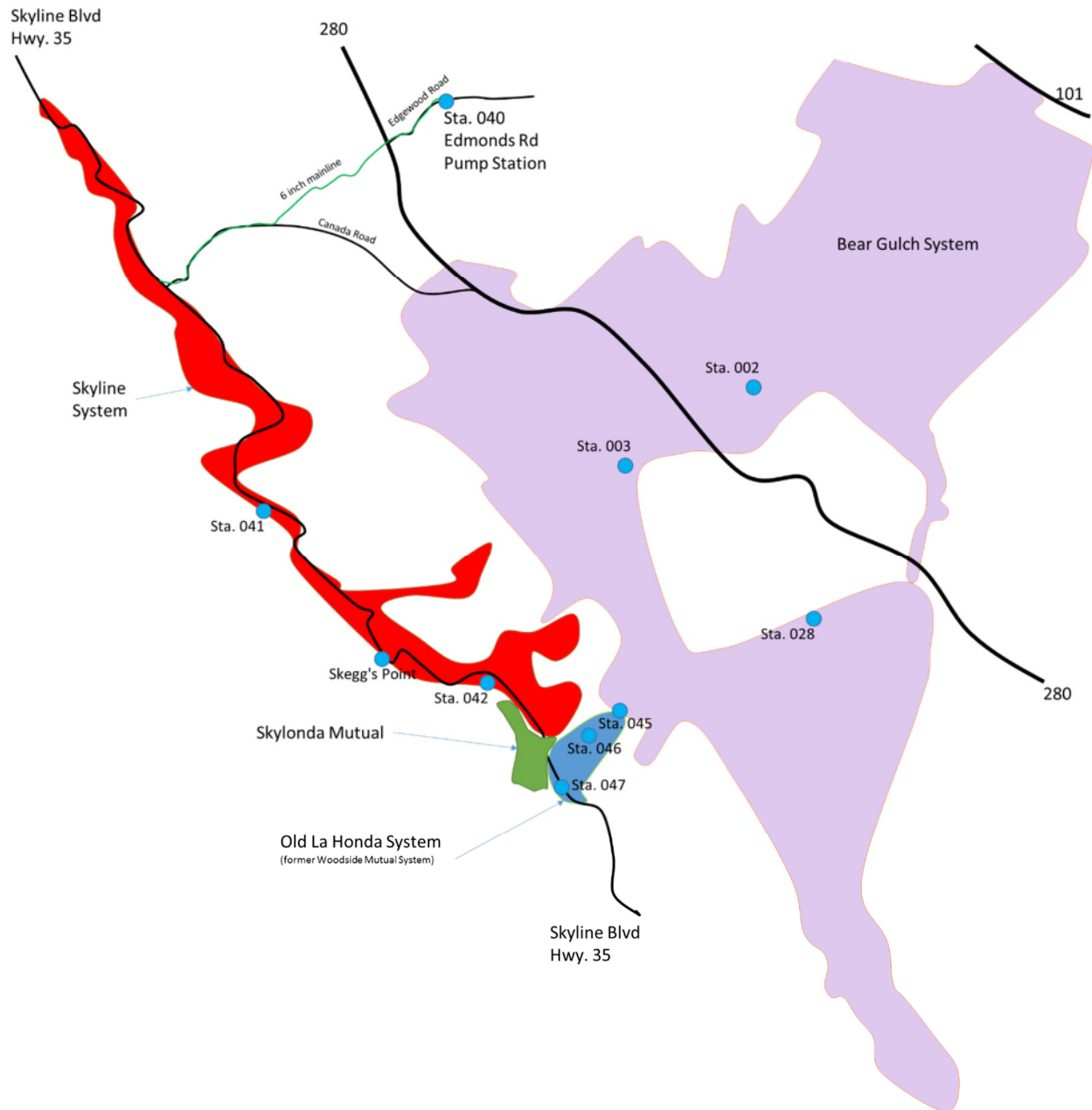
The source of supply for the Old La Honda System area are SFPUC supplies via Station 45, which has its source from the lower Bear Gulch Zone 1025. Pumps at Station 45 supply Zone 1255 and Station 46. Pumps at Station 46 supply Zone 1810 and Station 47. Pumps at Station 47 supply a small pressure system within the 1810 zone.

A diagram showing the general location of each of Bear Gulch District Systems is shown in Figure 3-1.

#### 3.1.1 Public Water System (PWS)

Cal Water's Skyline System is identified by the Division of Drinking Water as Public Water System (PWS) CA4110015. Cal Water's Old La Honda System is identified as PWS CA4100546. Both of these systems have been incorporated the Bear Gulch System (PWS CA4110006).

Figure 3-1: Diagram of Bear Gulch District Systems with Key Facilities



### 3.2 Pressure Zones

Water distribution systems are divided into pressure zones. A pressure zone is an area of service supplied by a source or a number of sources that provides a constant hydraulic gradient and is bounded by both a lower and upper elevation. Typically, the hydraulic gradient is provided by the high water level of the reservoir serving the pressure zone. For pressure zones with no gravity storage, the hydraulic gradient may be provided by pumping from a water source, such as a well or booster pump. A pressure zone can also feed a lower pressure zone by cascading flows by pressure reducing valve. Pressure zone names correspond to the hydraulic grade line elevation of that zone. Typically, the hydraulic grade line is calculated by taking the ground elevation in the zone and adding the pressure in the zone converted to feet of head.

#### Skyline System

The Skyline System has 17 pressure zones. The key pressure zones in the system are:

Zone 1435 - It is geographically close to the Bear Gulch System's Zones 1255 and 1810 and should be considered as a future point of interconnection between the two systems. Landslides on Martinez Rd. and Grandview Dr. will make the interconnection difficult.

Zone 1545 - This zone is located along Bear Gulch Road East, a private road with limited access.

Zone 1610 - This area is known as Skywood Acres.

Zone 1740 - This zone is located along Bear Gulch Road East, a private road with limited access.

Zone 1975-A - This zone is located along Bear Gulch Road East, a private road with limited access.

Zone 2215 - This zone is located along Bear Gulch Road East, a private road with limited access.

Zone 2370 - The entire supply for the system, provided by Station 40 (Edmonds Road Pump Station), is transferred through this zone. Station 41's (Headquarters Tanks) tanks not only establish the zone's hydraulic grade and provide storage for the system, they separate the northern and southern portions of the zone. Supply for the southern part of the distribution system must travel through the tanks before delivery.

Zone 2450 - This zone receives supply from Station 43, a small booster facility, and serves 4 customers. This is the highest zone in the Bear Gulch District. The demand for the 4 services have been combined with the Zone 2370.

Table 3-1 summarizes the key facilities that supply water into and out of each zone, and existing storage facilities in the zones. Key features of the major facilities are described in the rest of this section.

Appendix A2 shows the existing system schematic. Overview of the pressure zones with each zone shown in a different color is shown in Appendix C1.

Table 3-1: Skyline System Zones and Key Facilities

Zone Designation	Sources of Supply	Deliveries out of Zone	Storage in Zone
1205	PRV from Zone 1425	---	---
1425	PRV from Zone 1610	Zone 1205	---
1435	PRV from Zone 1610	---	---
1545	PRV from Zone 1740	---	---
1610	Control valve at Sta. 42	Zone 1425 Zone 1435	Station 42 (Skywood Tanks)
1740	PRV from Zone 1975-A	Zone 1545	---
1845	PRV from Zone 1965	---	---
1965	PRV from Zone 2170	Zone 1845	---
1975-A	PRV from Zone 2215	Zone 1740	---
1975-B	PRV from Zone 2185	Control valve at Station 42	---
2150	PRV from Zone 2370	---	---
2160	PRV from Zone 2370	---	---
2170	PRV from Zone 2370	Zone 1965	---
2185	PRV from Zone 2370	Zone 1975-B	---
2215	PRV from Zone 2370	Zone 1975-A	---
2370	Station 40	Zone 2215 Zone 2185 Zone 2170 Zone 2160 Zone 2150	Station 41 (Headquarters Tanks)
2450	Station 43	N/A	---

### Old La Honda System

The Old La Honda System has 2 pressure zones as summarized in the following table.

Table 3-2: Old La Honda System Zones and Key Facilities

Zone Designation	Sources of Supply	Deliveries out of Zone	Storage in Zone
1255	Station 45	1810	Station 046 (Orchard Hill Tanks)
1810	Station 46	1936	Station 047 (Big Tree Tank)

Appendix A3 shows the existing system schematic. Overview of the pressure zones with each zone shown in a different color is shown in Appendix C2.

### 3.3 Stations

#### Skyline System

Cal Water designates key system facilities (wells, pump stations, storage tanks) as stations, with a corresponding number. This section provides a summary of the stations. Sections 3.4 through 3.6 provide more details on the stations. The Skyline water system includes five stations.

- Station 40 is a high lift pump station that takes supply from the SFPUC connection and pumps it to the top of the Skyline Ridge (Zone 2370.)
- Station 41 tanks (Headquarters Tanks) are filled by Station 40 pumps. This station is located at the former headquarters for SCWD
- Station 42 tanks (Skywood Tanks) purpose is to provide storage for the 1610, 1435, 1425, and 1205 zones. The tank is filled from the 2370 zone by a control valve that opens at a predetermined tank level, but limits flow in an attempt to maintain pressures at the higher elevations of the 2370 zone by reducing pressure loss across the zone. Pressure at the higher elevations of the 2370 zone drop below 40 psi under peak demand conditions.
- Station 43 is a pump station that serves the 2450 zone (four customers). Boosters A and B take supply from the 2370 zone and pump to the 2450 zone
- Station 44 is a well site, with an inactive well. The well may be artesian and may be classified as groundwater under direct influence of surface water.

A summary of the stations is presented in the following table.

Table 3-3: Skyline System Stations

Station Number	Legacy Names	Station Type
40	Edmonds Pump Station	Pump
41	Skyline Head Quarters	Tanks
42	Skyline Tanks	Tanks
43	-	Pump
44	Well 044-01	Well

#### Old La Honda System

The Old La Honda water system includes three stations.

- Station 45 is a pump station that supplies water to the Old La Honda System area. The station receives water from 1025 zone.
- Station 46 tank and booster station. Currently, the existing tanks have been destroyed and temporary tanks installed until two new tanks have been constructed. These tanks are to be completed by summer of 2018.
- Station 47 tank and booster station. Tanks have been constructed in 2016 and pumps have been replaced in 2018.

A summary of the stations is presented in the following table.

Table 3-4: Old La Honda System Stations

Station Number	Legacy Names	Station Type
45	Upper Lake Tank	Tank/booster
46	Orchard Hill Tanks	Tank/booster
47	Big Tree Tank	Tank/ booster

### 3.4 Groundwater Wells

Currently there are no active groundwater wells in the Skyline or Old La Honda Systems.

Station 44 in the Skyline System has an inactive well which has been disconnected from the system. It has not been operated since the mid-1980s because at the time, an iron and manganese treatment system was needed to continue using the well. When Cal Water acquired the system in 2009, the Division of Drinking Water (DDW) informed Cal Water that activating this well would be considered a new source and would require approval prior to use as a potable water supply. Furthermore, because the sanitary seal is less than the required 50-foot minimum depth, DDW would only permit the BG Station 44 well water source as 'groundwater under direct surface water influence' and therefore the well would require additional treatment to meet primary drinking water standards.

Cal Water completed a review of the existing BG Well 44-01 to evaluate the potential estimated well yield and requirements to obtain a permitted well at this site. The review identified that it was not feasible to rehabilitate the existing well and that a new proposed well could be located onsite. Drilling a new well and properly installing the required sanitary seal at this site would be a better solution to adding additional supply. It was anticipated that the well water will require additional treatment through an iron and manganese treatment system proposed to be located onsite. The capacity of this well is estimated at 50 GPM.

A new well (BG Well 44-02) was requested as part of the 2015 GRC, but high cost of construction and treatment compared to the low yield and current demands needs, this project was not pursued. Current demands have not required the well to be requested in future rate cases to date.

A well siting study was planned to be developed to investigate other locations of potential wells but was delayed at this time due to not being cost effective at this time.

### 3.5 Booster Stations

#### Skyline System

The Skyline System has two booster stations. Station 40 transfers supply from the SFPUC connection at Edmonds Road. Station 43 is a small booster station supplying four services.

Table 3-5: Skyline System Pump Stations

Station Number	Pump Letter	Suction Zone	Discharge Zone	Design Head (ft)	Power (HP)	Year Installed	Rated capacity (gpm)	Back-up Power
40	A	SFPUC connection	2370	2420	300	2012 rebuilt	300	Yes (installed Summer 2018)
	B	SFPUC connection	2370	2420	300	2012 rebuilt	300	
43	A	2370	2450	92	5	unknown	80	No
	B	2370	2450	92	5	unknown	80	No

Old La Honda System

The Old La Honda System has three booster stations. Station 45 transfers supply from the Zone 1025 to Zone 1255. Station 46 transfers supply from the Zone 1255 to Zone 1810. The units are being installed under capital projects ID 97519 and 99325. Station 47 transfers supply from the tanks to within the Zone 1810.

Table 3-6: Old La Honda System Pump Stations

Station Number	Pump Letter	Suction Zone	Discharge Zone	Design Head	Power (HP)	Year Constructed	Rated capacity (gpm)	Back-up Power
45	A	1025	1255	370	20	2010 or 2018	70	No
	B	1025	1255	440	40	2010 or 2018	75	No
46	A	1255	1810	Unknown	25	2018	100	Yes
	B	1255	1810	Unknown	Unknown	2018	75	Yes
47	A	1810	-	190	Unknown	2018	26	Yes
	B	1810	-	190	Unknown	2018	26	Yes

### 3.6 Reservoirs/Storage

#### Skyline System

The Skyline System currently has four distribution system reservoirs with a total storage capacity of 0.5 MG. Station 42, tanks T1 and T2 will be replaced with 042-T3 in 2018.

Table 3-7: Skyline System Tanks

Station & Tank Number	Legacy Name	Material	Year Constructed	Volume (MG)	Bottom Elevation (ft)	Overflow height (ft)	Diameter (ft)	Status
41-T1	Headquarters Tanks	Welded Steel	1979	0.189	2370			Active
41-T2		Welded Steel	1999	0.192	2370			Active
42-T1	Skywood Tanks	Bolted Steel	Unknown	0.060	~1900	16.5	~21	Active **
42-T2		Bolted Steel	Unknown	0.060	~1900	16.5	~21	Active **
42-T3		Bolted Steel	Planned 2018	0.250				In Progress
Total				0.501 0.631	with 042-T1 and 042-T2 without 042-T3 without 042-T1 and 042-T2 with 042-T3			

\*\* to be replaced w/ 42-T3 in 2018

#### Old La Honda System

Prior to Cal Water's acquisition of the Old La Honda System, all of the storage tanks in the system were constructed of redwood material. The original construction date of these tanks is not known, but presumably were constructed when Old La Honda Mutual was first established during the 1950's. Because of extreme deterioration, all of the tanks have been replaced or are in the process of being replaced.

Table 3-8: Old La Honda System Tanks

Station & Tank Number	Legacy Name	Material	Year Constructed	Volume (MG)	Bottom Elevation (ft)	Overflow height	Diameter (ft)	Status
45-T1	Upper Lake	Redwood	-	-	-	-	-	destroyed
46-T1	Orchard Hill	Redwood	-	-	-	-	-	destroyed
46-T2		Redwood	-	-	-	-	-	destroyed
46-T3		Bolted Steel	~2018	0.064	1283	20'	24	In progress **
46-T4		Bolted Steel	~2018	0.064	1283	20'	24	In progress **
47-T1	Big Tree	Redwood	-	-	-	-	-	destroyed
47-T2		Bolted Steel	2016	0.075	1826	18' 10.5"	26	active
47-T3		Bolted Steel	2016	0.075	1826	18' 10.5"	26	active
Total				0.278				

\*\* Construction complete by summer 2018

Tank 45-T1 has been destroyed. Currently, there are no plans to replace this tank.

Tanks 46-T3 and 46-T4 are being constructed to replace the original redwood Tanks 46-T1 and 46-T2. Temporary HDPE tanks have been installed during construction to keep this station operational until the new tanks have been constructed.

Tanks 47-T1 and 47-T2 have replaced the original redwood tank in 2016.

### 3.7 Emergency Standby Connections

#### Skyline System

The Skyline System is isolated from the main Bear Gulch System. The only adjacent water system to the Skyline is the Skylonda Mutual Water System. The Skylonda system has limited supply with one emergency connection; however, this system does not have the capacity to supply the Skyline System.

Currently, there is a little over 500,000 gallons of storage in the Skyline System, which allows for temporary outages of Station 40. Cal Water does not currently have any other means to supply water to the Skyline System. However, there may be a way to connect the Skyline System to Zones 1810 or 1255 of the Old La Honda System. Options are being investigated for future system improvements. Based on these options, a temporary connection can be installed during a disaster or other water shortage needs. It should be noted that this connection would only bring supply to the Zone 1610 and the zones it feeds. Additional pumping would be needed to bring supply to the Zone 2370.

#### Old La Honda System

The Old La Honda System only connection is with the main Bear Gulch System. Skylonda Mutual Water System neighbors the Old La Honda System, but there are no emergency connections.

### 3.8 Pressurized Mains

#### Skyline System

The following table summarizes the existing pipelines by installation data. The information was obtained from the GIS database. There are about 26 miles of pipe in both systems.

As indicated, about 55 percent of the existing pipelines in Skyline were installed before 1960 and more than 85 percent was installed before 1970. Cal Water has a Main Replacement Program and has identified several sections within the Skyline System to replace the aging pipes, as discussed in Chapters 7 and 8.

Table 3-9: Skyline System Pressurized Mains by Installation Date (2017)

Year Installed	Length (ft)	Percentage
1937	25	0.0%
1948	43,727	37.0%
1950	57	0.0%
1951	9,905	8.4%
1953	2,394	2.0%
1957	627	0.5%
1963	41,544	35.1%
1973	306	0.3%
1980	2,725	2.3%
1984	104	0.1%
1989	393	0.3%
1991	1,222	1.0%
2000	7,774	6.6%
2001	7,461	6.3%
2015	20	0.0%
<b>Total</b>	<b>118,285</b>	<b>100.0%</b>

The following table summarizes the existing pipelines by diameter and material, respectively. The information was obtained from the GIS database.

Table 3-10: Skyline System Pressurized Mains by Diameter (2017)

Diameter (inch)	Length (ft)	Percentage
Unknown	57	0.05%
0.5	10	0.01%
1.5	603	0.51%
2	880	0.74%
2.5	22	0.02%
3	69	0.06%
4	11,584	9.79%
6	101,240	85.59%
8	1,842	1.56%
10	473	0.40%
12	1,504	1.27%
<b>Total</b>	<b>118,285</b>	<b>100.00%</b>

As indicated, about 86 percent of the existing pipelines is 6-inch for the Skyline System. This is the backbone of the system that supplies throughout the region. As indicated in the previous table, most of this mainline was installed prior to 1970. The following table list the Skyline System mains by material.

Table 3-11: Skyline System Pressurized Mains by Material (2017)

Material	Length (ft)	Percentage
AC	44,192	37.4%
CU	104	0.1%
DI	7,975	6.7%
GALV	1,222	1.0%
PE	-	-
PVC	10,397	8.8%
STL	9,905	8.4%
TRANS	43,727	37.0%
UNK	762	0.6%
<b>Grand Total</b>	<b>118,285</b>	<b>100.0%</b>

About 74 percent of the existing pipelines in the Skyline System are asbestos cement (AC) or transite (TRANS), which is an older form of asbestos cement. About 8 percent uncoated steel (STL). The remaining material types, 18%, include copper (CU), ductile iron (DI), galvanized steel (GALV), polyvinyl chloride (PVC), and unknown (UNK).

#### Old La Honda System

There is approximately 8,400 feet (1.6 miles) of main in this system. Approximately 6,700 feet of main between Stations 45 and 46 was replaced in 2009. The remaining piping has been recently replaced.

Table 3-12: Old La Honda System Pressurized Mains by Installation Date (2017)

Year Installed	Length (ft)	Percentage
2009	6,658	80.0%
2012	319	4.0%
2015	1,393	17.0%
<b>Total</b>	<b>8,370</b>	<b>100.0%</b>

The following table summarizes the existing pipelines by diameter.

Table 3-13: Old La Honda Pressurized Mains by Diameter (2017)

Diameter	Length (ft)	Percentage
1	1,667	20%
4	5,065	61%
6	340	4%
8	1,297	15%
<b>Total</b>	<b>8,370</b>	<b>100%</b>

As indicated in the following table, the majority of the mains, 61%, are 4-inch. In the Old La Honda System, the majority of the pipelines (60%) are uncoated steel (STL).

Table 3-14: Pressurized Mains by Material (2017)

Material	Length (ft)	Percentage
DI	1,713	20.5%
GALV	1,532	18.3%
PE	136	1.6%
STL	4,990	59.6%
Total	8,370	100.0%

### 3.8.1 Mainline Leaks

The leak database maintained by Cal Water includes the date and the location of leaks within the system. Maintaining updated leak records along with information on the cause of leaks assists in prioritizing main replacements in the on-going Mainline Replacement Program (MRP). In addition, it provides valuable data such as frequency of leaks, location of leaks, and distribution of leaks based on pipeline age and material. By periodically tracking leaks within the system, the District may be able to forecast pipeline replacements before a failure.

The following table summarizes the number of leaks in each system by year, along with the pipeline break rate. Overall, the Bear Gulch District has a breakage rate of 20 breaks / 100 mi / year. On average, the Skyline System is slightly less than the District overall. Likewise, the Old La Honda System is below average as well. In addition, because of the condition of the Old La Honda pipelines from the acquisition, the pipelines in the system needed to be replaced. Since the replacement, the Old La Honda System has had zero breaks.

Table 3-15: Leak Summary and Pipeline Break Rate

Year	Skyline		Old La Honda	
	Main Breaks / Yr	Breaks / 100 mi / Yr	Main Breaks / Yr	Breaks / 100 mi / Yr
2009	2	9	No info	No info
2010	3	13	2	9
2011	2	9	7	31
2012	2	9	1	4
2013	7	31	2	9
2014	5	22	1	4
2015	3	13	2	9
2016	2	9	0	0
2017	10	45	0	0

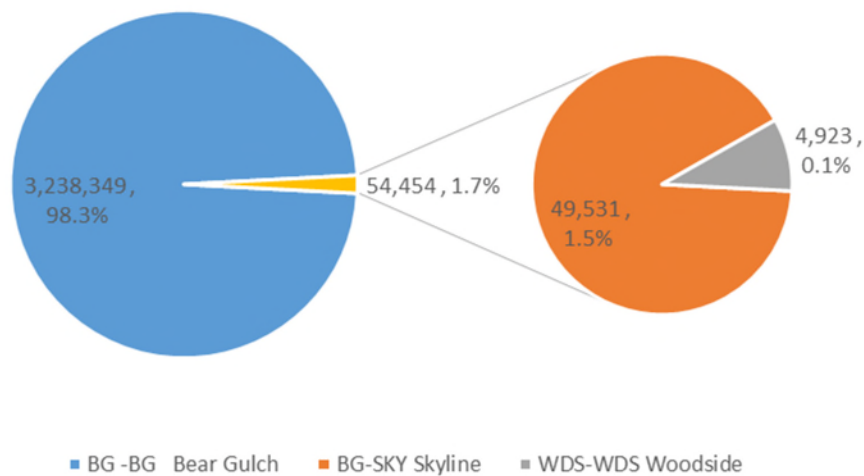
## 4. Water Demand

This section describes existing and projected demands for the Skyline and Old La Honda Systems.

### 4.1 Historical Water Demand

The following figure presents the relative demand of Skyline/Old La Honda in relation to the demand of Bear Gulch System. The total demand for the District in 2017 was 3,292 MGals with less than 2% attributable to Skyline/Old La Honda Systems

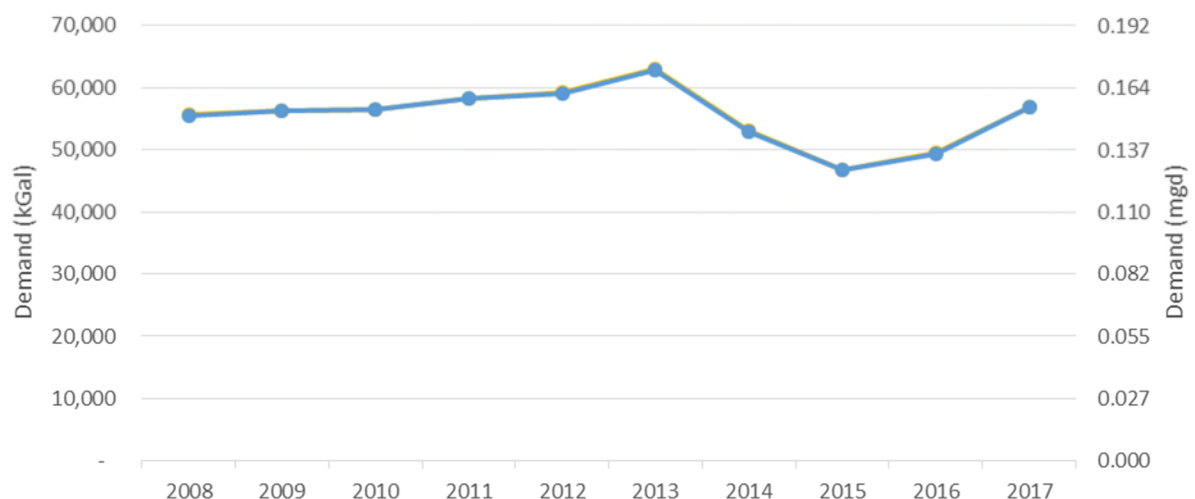
Figure 4-1: Relation of Total Demand



### Skyline System

Following graph presents the historical annual production for the Skyline System.

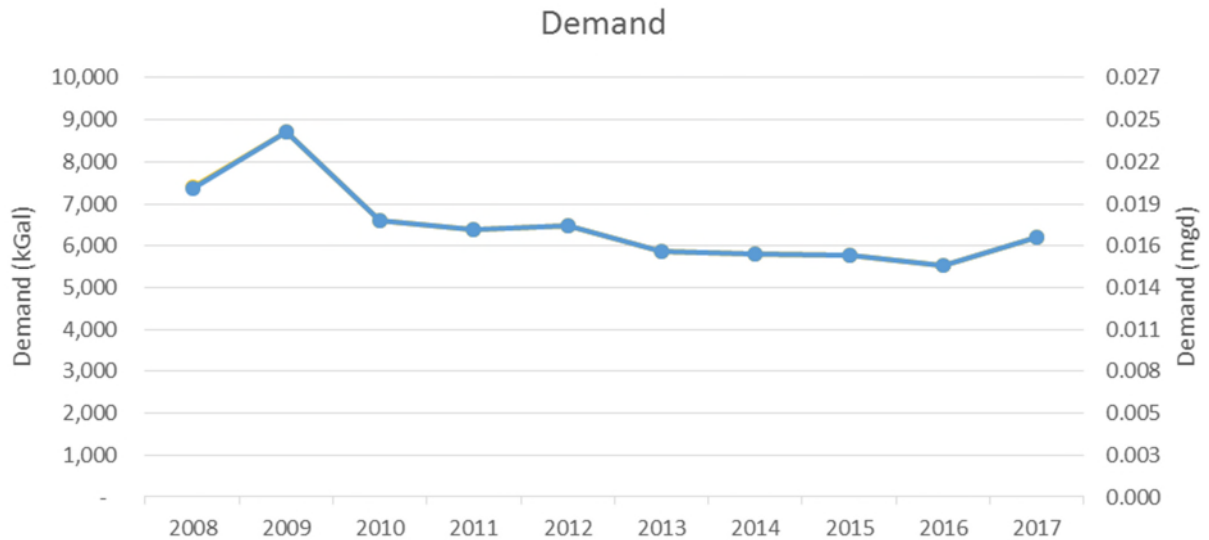
Figure 4-2: Annual Production for Skyline System



Old La Honda System

Following graph presents the historical annual production for the Old La Honda System.

Figure 4-3: Annual Production for Old La Honda System



## 4.2 Customer Use and Deliveries

Skyline System

The majority of the service connections are single family residential service but also include some commercial services. Multi-family residential, irrigation, and public authority services account for less than 1% of the total accounts in the Skyline System. The total annual demand for Skyline System is 56,914 thousand gallons (kGals), or 0.156 MGD, in 2017. Following table summarizes the existing customer demand estimates for Skyline System.

Table 4-1: Summary of Existing Demand by Customer Type for the Skyline System (2017)

Customer Type	Total Annual Demand (kGals)	Percent of Total Demand
Single Family Res.	41,995	73.7%
Multi-Family Res.	984	1.7%
Commercial	5,414	9.5%
Irrigation	56	0.1%
Other	28	0.0%
Public Authorities	396	0.7%
<b>Sub-total</b>	<b>48,833</b>	<b>85.8%</b>
Non-Revenue Water	8,081	14.2%
<b>Total</b>	<b>56,914</b>	<b>100.0%</b>

#### Old La Honda System

The majority of the service connections are single family residential service with one multi-family residential account. The total annual demand for Old La Honda System is 6,200 kGals, or 0.017 MGD, in 2017. The following table summarizes the existing customer service and demand estimates for Old La Honda System.

Table 4-2: Summary of Existing Demand by Customer Type for Old La Honda System (2017)

Customer Type	Total Annual Demand (kGals)	Percent of Total Demand
Single Family Res.	5,421	87.4%
Multi-Family Res.	378	6.1%
<b>Sub-total</b>	<b>5,799</b>	<b>93.5%</b>
Non-Revenue Water	401	6.5%
<b>Total</b>	<b>6,200</b>	<b>100.0%</b>

#### 4.2.1 Non-Revenue Water

Non-Revenue Water (NRW) refers to system losses between production (supply) and consumption (customer usage). These losses may occur from fire flows, construction use, hydrant flushing, leaks, main breaks, metering inaccuracies, illegal connections or usage, and other types of un-metered water use. Non-Revenue Water typically ranges from about 5 to 10 percent of production for most water systems.

#### Skyline System

NRW for the Skyline System averages 16%, slightly higher than typical. However, it would appear there is a slight decrease in trend of the NRW percentage, which is likely due to the recent improvement to the District's leak detection and maintenance program. The following table shows Cal Water's historical NRW for the Skyline System.

Table 4-3: Non-Revenue Water Estimate for Skyline System

	Total Sales (kGals)	Total Demand (kGals)	Non-Revenue Water	% Non-Revenue Water
2008	-	55,712	-	-
2009	38,657	56,342	17,685	31.4%
2010	52,796	56,548	3,752	6.6%
2011	48,773	58,243	9,470	16.3%
2012	52,557	59,352	6,795	11.4%
2013	61,103	62,972	1,869	3.0%
2014	52,113	53,070	957	1.8%
2015	42,303	46,748	4,445	9.5%
2016	43,453	49,531	6,078	12.3%
2017	48,833	56,914	8,081	14.2%

Old La Honda System

NRW for the Old La Honda System cannot be estimated because Station 45 located at Upper Lake Road is the only pump supplying water to the Old La Honda System. A meter on the suction side of pumps shows the flow to the area; however, the data is not regularly tabulated. For planning purposes, the non-revenue water estimates are taken from the Bear Gulch District totals as shown in the table below.

Table 4-4: Non-Revenue Water Estimate for Old La Honda System

	Total Sales (kGals)	Total Demand (kGals)	Non-Revenue Water	% Non-Revenue Water (Skyline/Bear Gulch District)
2008	7,027	7,401	374	5.1%
2009	8,278	8,701	423	4.9%
2010	6,306	6,607	301	4.6%
2011	5,957	6,378	421	6.6%
2012	6,285	6,491	205	3.2%
2013	5,531	5,877	346	5.9%
2014	5,571	5,815	244	4.2%
2015	5,529	5,788	259	4.5%
2016	5,222	5,547	325	5.9%
2017	5,799	6,200	401	6.5%

### 4.3 Water Demand Factors

The demand per service for each customer class since the systems have been acquired is presented in this section. The data covers the historical customer data records from 2008 to 2017. Graphs displaying the maximum/minimum for the time period, and the average for a 3-yr (2015-2017) and 9-yr (2009-2017) time period are presented in Appendix D.

Skyline System

The demand per service in the Skyline System steadily increased for single-family residential until 2013 when the drought conditions throughout California caused mandatory water restrictions. Since then, the demand per service has decreased by 31%. The multi-family residential, commercial, irrigation, and public authority have remained constant for the past three to five years. The NRW is showing highly variable values for the historical record. The minimum was reached in 2014 and has an increasing trend since. For the combine demand per service, the system has seen 25% decrease from 2013 to 2015 and is now showing signs of rebound occurring after the drought. Appendix D1 graphically summarizes the historical demand per service for the Skyline System.

The historical demand per service for the Skyline System is summarized in the following table.

Table 4-5: Demand per Service (gal/serv/day)

	Maximum	Average (9-yr)	Average (3-yr)	2017	Minimum
Single Family Res.	327	260	233	252	215
Single Family Res (flat)	-	-	-	-	-
Multi-Family Res.	3,885	3,182	3,260	2,697	2,120
Commercial	1,907	1,240	1,202	1,348	670
Industrial	-	-	-	-	-
Irrigation	154	61	72	154	16
Other	19	3	10	19	-
Other	-	-	-	-	-
Public Authorities	542	265	412	542	119
NRW	103	38	36	47	6
Combined	373	325	298	328	278

#### Old La Honda System

The single-family residential demand per service has steadily decreased since the system has been acquired, with the current value at near minimum. The multi-family residential and NRW has shown high variability during the historical record but is currently about 10 percent less than the 3-yr average value. The combined values follows the trend of the single-family residential demand per service. Appendix D2 graphically summarizes the historical demand per service for the Old La Honda System.

The historical demand per service for the Old La Honda System is summarized in the following table.

Table 4-6: Demand per Service (gal/serv/day)

	<u>Maximum</u>	<u>Average (9-yr)</u>	<u>Average (5-yr)</u>	<u>2017</u>	<u>Minimum</u>
Single Family Res.	483	341	314	338	294
Commercial	1,619	1,375	1,350	1,035	281
NRW	25	19	19	24	12
Combined	507	378	356	377	329

#### 4.3.1 Peaking Factors

Water system facilities are generally sized for peak demand periods. The peaking conditions of most concern for water facility sizing are (1) maximum day demand with fire flow and (2) peak hour demand on the maximum day.

Average day demand refers to the average daily usage of water over a year. Maximum day demand is the maximum water usage for a 24-hour period during a year, which generally occurs during the maximum month of usage in summer. Peak hour demand is the peak flow during a one-hour period on the day of maximum demand.

Skyline System

The maximum day peaking factor relates the maximum day average daily demand to the annual average day system demand. SCADA data for the Skyline System is limited to the period from August 2015 to the present. The average of the ratio of the Max Day to Average Day is 2.3. This maximum day peaking factor is used to determine the Maximum Day Demands for 2008 to 2014. For the master plan, a maximum day peaking factor of 2.3 is recommended as a reasonable value for master planning purposes.

The peak hour factor is 1.5 times the maximum day demand. Therefore, the peak hour demand is approximately 3.45 times the average day demand.

Table 4-7 summarizes historical demand data including total annual demand, average daily demand, and maximum day demand. The table also shows the relationship (peaking factor) between maximum day demand and average daily demand. The highest demand during 10-year (2008 to 2017) period is 2013 with 62,972 kGals or 0.173 MGD.

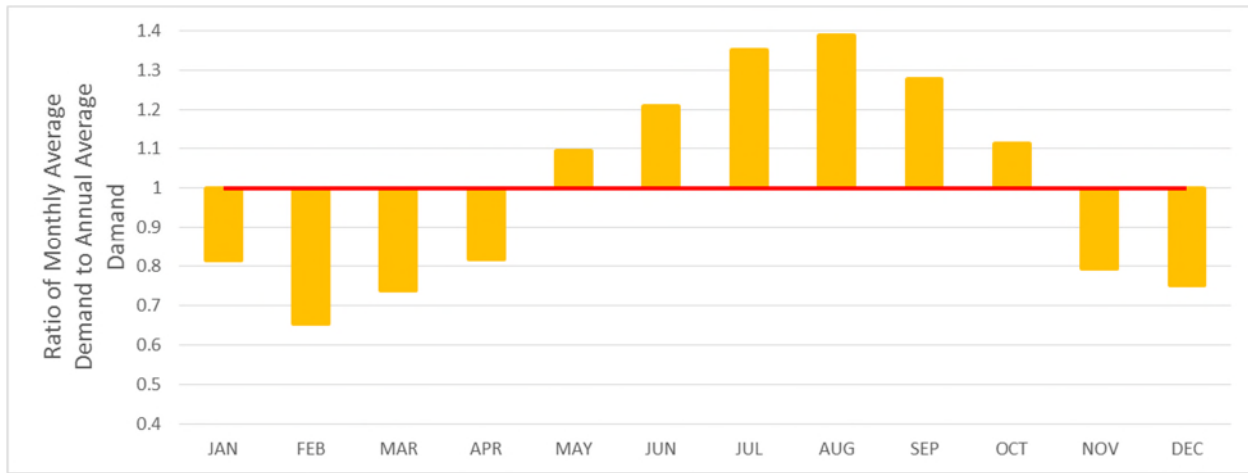
Table 4-7: Summary of Historical Demand and Peaking Factors for Skyline System

Year	Annual Demand (kGals)	Average Day Demand (mgd)	SCADA Max Day Demand (mgd)	Maximum Day Demand (mgd)	Max. Day Peaking Factor
2008	55,712	0.153		0.352	2.30
2009	56,342	0.154		0.354	2.30
2010	56,548	0.155		0.357	2.30
2011	58,243	0.160		0.368	2.30
2012	59,352	0.163		0.375	2.30
<b>2013 (maximum annual use)</b>	<b>62,972</b>	<b>0.173</b>		0.398	2.30
2014	53,070	0.145		0.334	2.30
2015	46,748	0.128	0.256	0.256	2.00
2016	49,531	0.136	0.305	0.305	2.24
2017	56,914	0.156	0.381	0.381	2.66

Monthly demands are also of interest in water system planning, since the level of water use may vary significantly over the course of a year. Figure 3.9 shows the ratios of the monthly average day demand to the annual average day demand. The monthly ratios relate the monthly average daily flow to the annual average daily flow. The ratios are based on the 6-year averages usage from 2011 through 2016.

As indicated on Figure 4-4, the monthly average demand ranges from about 0.63 times the annual average demand in the winter to 1.4 times the annual average demand in the summer.

Figure 4-4: Skyline System Monthly Demand Factors



#### Old La Honda System

The maximum day peaking factor relates the maximum day average daily demand to the annual average day system demand. Prior to 2018, SCADA was not installed to monitor the flowrates for the Old La Honda System. To estimate the Max Day demand for the Old La Honda System, a ratio of the Max Day Demand to the Average Day Demand for the entire Bear Gulch District was used times the Average Day Demand for the Old La Honda System. The average of the ratio of the Max Day to Average Day is 1.8. Based on limited data, a maximum day peaking factor of 1.8 is the recommended value for master planning purposes.

The peak hour factor is 1.5 times the maximum day demand. Therefore, the peak hour demand is approximately 2.7 times the average day demand.

Table 4-8 summarizes historical demand data including total annual demand, average daily demand, and maximum day demand for Old La Honda System. The table also shows the relationship (peaking factor) between maximum day demand and average daily demand. The highest demand during 10-year (2008 to 2017) period is 2009 with 8,701 kGals or 0.024 MGD.

Table 4-8: Summary of Historical Demand and Peaking Factors for Old La Honda System

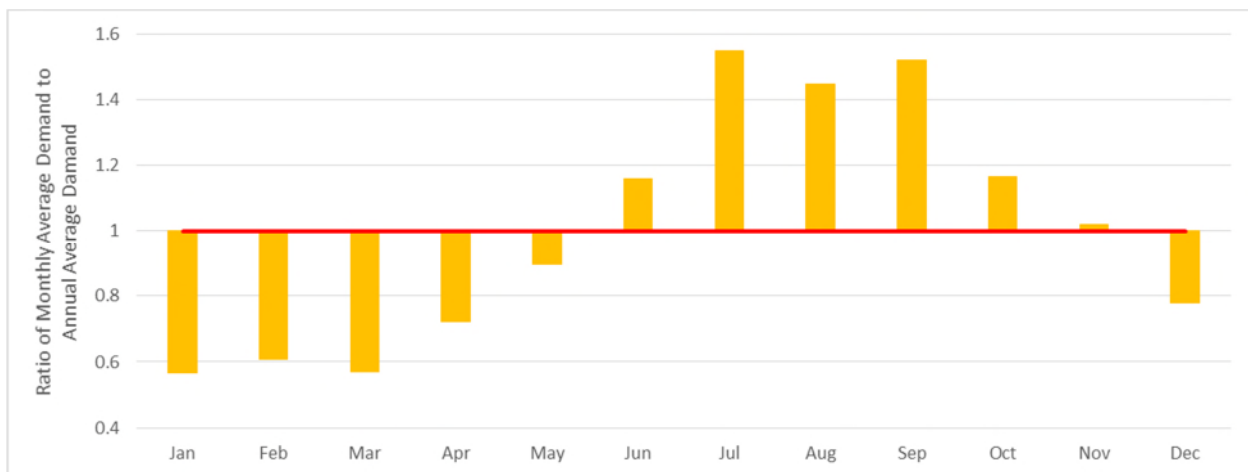
Year	Annual Demand (kGals)	Average Day Demand (mgd)	SCADA Max Day Demand (mgd)	Maximum Day Demand (mgd) <sup>1</sup>	Max. Day Peaking Factor
2008	7,401	0.020	-	0.034	1.68
<b>2009 (maximum annual use)</b>	<b>8,701</b>	<b>0.024</b>	-	<b>0.041</b>	<b>1.73</b>
2010	6,607	0.018	-	0.035	1.95
2011	6,378	0.017	-	0.031	1.75
2012	6,491	0.018	-	0.033	1.83
2013	5,877	0.016	-	0.028	1.75
2014	5,815	0.016	-	0.026	1.65
2015	5,788	0.016	-	0.026	1.66
2016	5,547	0.015	-	0.029	1.91
2017	6,200	0.017	-	0.049	1.66

<sup>1</sup> The ratio of the Max Day Demand to the Average Day Demand for the entire Bear Gulch District was used to estimate the Max Day Demand for the Old La Honda System.

Figure 4-5 shows the ratios of the monthly average demand to the annual average demand. The monthly ratios relate the monthly average daily flow to the annual average daily flow. The ratios are based on the 4-year average usage from 2013 through 2016.

As indicated on Figure 4-5, the monthly average demand ranges from about 0.61 times the annual average demand in the winter to 1.55 times the annual average demand in the summer.

Figure 4-5: Old La Honda System Monthly Demand Factors



#### 4.4 Projected Water Demands

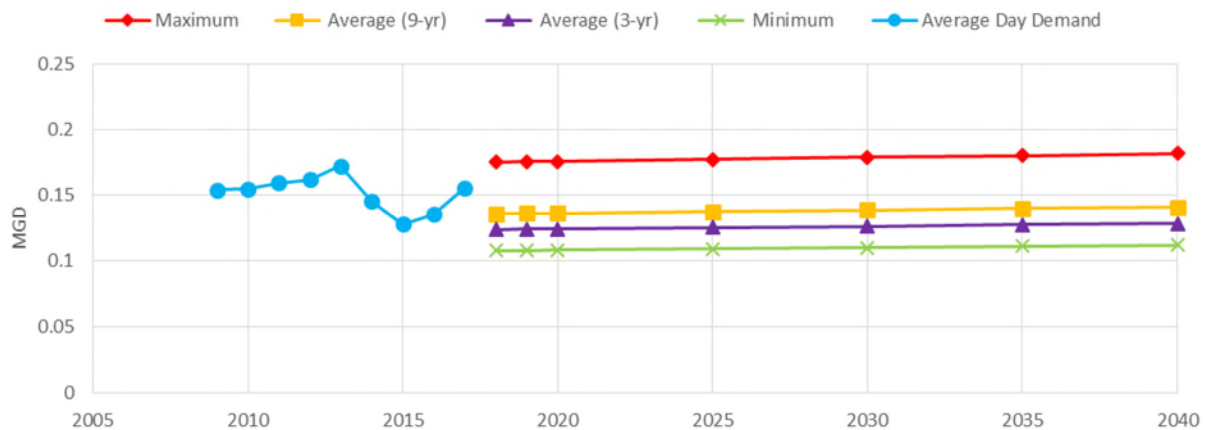
The recommended planning-level demand projections are summarized first, followed by a discussion of the sensitivity analysis of low to high projection ranges.

Several scenarios have been calculated to estimate future demands based on 3-year average, 9-year average, minimum, and maximum to show a range of possible future demands.

### Skyline System

Projections of future demands have been developed using the projected services and the historical demands per service from Chapter 3. Individual growth rates and unit demands were used for each customer type. Demand per services for the 3-year average, 9-year average, minimum, and maximum were used to show a range of possible future demands. The following graph was developed to show the historical demands for each demand scenario.

Figure 4-6: Skyline System Demand Projections



Based on visual inspection and conservative judgement, the maximum demand curve is chosen as the baseline curve. The values of the baseline projected demands through 2040 are tabulated in the following table.

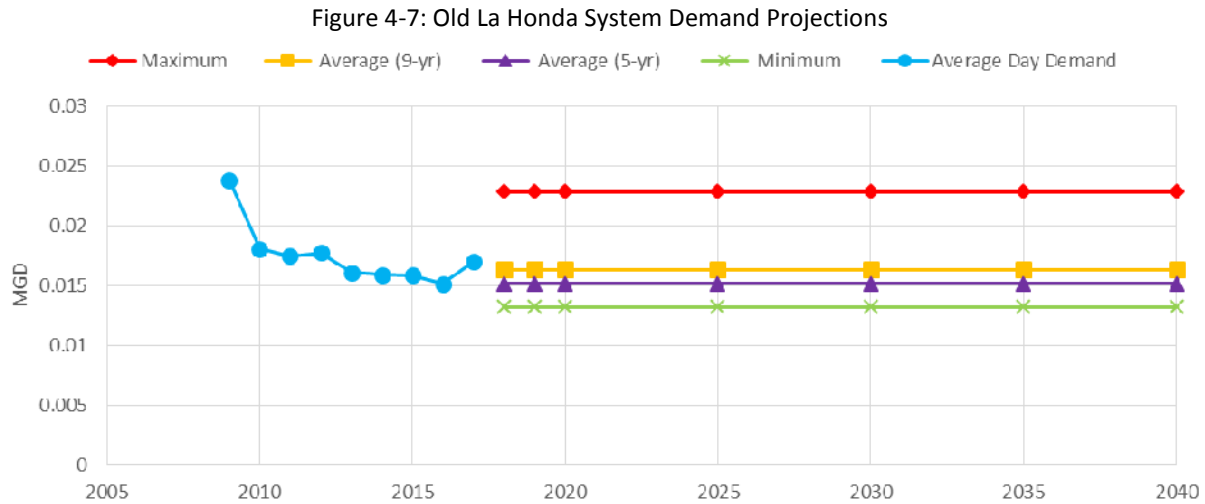
Table 4-9: Summary of Planning-Level Demand Projections for Skyline System

Year	Total Projected Services	Estimated Population in Service Area	Baseline (Maximum Demand per Service)			
			Average Day Demand		Total Per Service Demand	Total Per Capita Demand
			(kGal/year)	(MGD)	(gpd)	(gpd)
2017 (current)	475	981	56,914	0.156	328	158
2020	477	993	64,277	0.176	373	177
2025	481	1,003	64,821	0.178	373	177
2030	486	1,013	65,364	0.179	373	177
2035	490	1,023	65,907	0.181	373	177
2040	495	1,032	66,451	0.182	373	176

### Old La Honda System

Projections of future demands have been developed using the projected services and the historic demands per service from Chapter 3. Individual growth rates and unit demands were used for each customer type. Demand per services for 5-year average, 9-year average, minimum, and maximum were

used to show a range of possible future demands. The following graph was developed to show the historical demands for each demand scenario.



Based on visual inspection and conservative judgement, the 9-yr Average demand curve is chosen as the baseline curve. The values of the baseline projected demands through 2040 are tabulated in the following table.

Table 4-10: Summary of Planning-Level Demand Projections for Old La Honda System

Year	Total Projected Services	Estimated Population in Service Area	Baseline (9-yr Average)			
			Average Day Demand		Total Per Service Demand	Total Per Capita Demand
			(kGal/year)	(MGD)	(gpd)	(gpd)
2017 (current)	45	99	6,200	0.017	377	172
2020	45	99	5,971	0.016	378	165
2025	45	99	5,971	0.016	378	165
2030	45	99	5,971	0.016	378	165
2035	45	99	5,971	0.016	378	165
2040	45	99	5,971	0.016	378	165

#### 4.4.1 Demand Changes due to Conservation

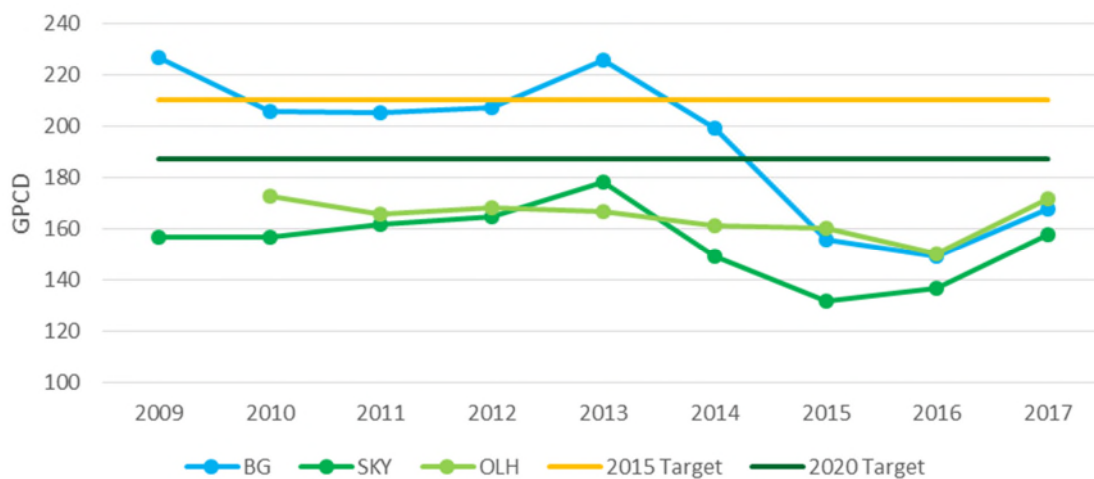
Cal Water is committed to helping its customers use water efficiently and has developed a range of water conservation programs to support this goal. To ensure that it is providing the right mix of programs in the most cost-effective manner possible, Cal Water routinely conducts comprehensive conservation program analysis and planning. This is done on a five-year cycle in tandem with the Urban Water Management Plan (UWMP). The results of this planning for the Bear Gulch District are summarized in Cal Water's Conservation Master Plan, which covers the period 2016 to 2020. The main purposes of the Conservation Master Plan are to:

- Serve as a broad guidance document that helps inform annual conservation activities, such as program levels, staffing, and budget needs both internally and for stakeholders;
- Summarize the mix of conservation measures that Cal Water plans to implement going forward, including the estimated water savings, costs, and effects on water demand;

- Explain the evaluation process and factors considered in selecting conservation measures;
- Provide an update to the 2011-15 Conservation Master Plan as part of a five year review cycle to assess program performance and identify the need for any adjustments; and
- Ensure Cal Water districts are on a path to meet their demand-reduction requirements under the Water Conservation Act of 2009 (SB X7-7), which mandated a 20 percent reduction in per capita water use by 2020.

The Skyline and Old La Honda Systems are incorporated into the Bear Gulch District. All conservation programs discussed in the Conservation Master Plan are applicable to these systems. Currently, these two systems have Gross Per Capita demands meeting both 2015 and the 2020 conservation targets. As shown in the following graph, there is a trend upwards due to rebounding effect from the recent drought. It is anticipated that the current conservation programs will minimize this trend so that the 2020 legislated target is met, and thus a reduction in overall demand. The per capita demands and conservation measures will be re-evaluated when the Conservation Master Plan update is completed, in tandem with the 2020 Urban Water Management Plan.

Figure 4-8: Historical GPCD & State Legislated Targets



#### 4.4.2 Demand Changes due to Climate Change

A hotter and drier climate is expected to increase demand for outdoor water use. A selection of climate change scenarios for 2040 for the Southwest United States contained in the Regional Climate Trends and Scenarios for the U.S. National Climate Assessment, is shown in Table 4-11, along with the expected effect on District water demand. Based on the scenarios in the table, temperature increases by 2040 associated with climate change imply a 2 to 3 percent increase in demand relative to weather normalized demand. This expected effect is solely due to predicted changes in temperature. While the climate change scenarios also include predicted changes in the pattern and amount of precipitation, this has not been included in Cal Water's demand modeling due to the large uncertainty associated with these estimates.

Table 4-11: Climate Change Effect on Demand

Climate Scenario	Year 2040 degree F	% Change from mean Temperature	Temperature Effect on Demand
B1	2.5	3.4%	2.0%
A1B	2.9	3.9%	2.3%
A2	2.7	3.7%	2.1%
80%ile	3.6	4.9%	2.8%

## 5. Supply Sources

This section discusses the existing water supply sources, key issues that may impact these supplies (e.g., reliability, future water quality regulations, and potential water quality issues), and identifies the requirements for future supply.

### 5.1 Existing Sources of Water – Purchased Water

Surface water supplies from the SFPUC are currently the only source of supply for both the Skyline System and Old La Honda service areas.

Cal Water currently has a 25-year Water Supply Agreement (WSA) with SFPUC that was adopted in 2009 and will expire in 2034, with possible extensions to 2044. Cal Water has an allocation from the SFPUC, called the Individual Supply Guarantee (ISG). The ISG can be distributed between the Bear Gulch and Bayshore (San Mateo, San Carlos, and South San Francisco systems) Districts at the company's discretion. Cal Water has purchased supply in excess of its ISG during years where there is no declaration of shortage by the SFPUC and additional supply is available. Normally, a penalty would be imposed for purchased supply in excess of the ISG. In dry years, SFPUC supplies are allocated based on a computation stipulated to under the current contract.

The Raker Act, enacted by the US Congress in 1913, permitted building the O'Shaughnessy Dam and flooding of the Hetch Hetchy Valley, but did not allow the sale of water from Hetch Hetchy to private utilities. As an investor-owned utility, Cal Water is not permitted to purchase water from the Hetch Hetchy system; however, provisions do allow locally generated water to be purchased by private entities. Approximately 15% of the water in the SFPUC system is locally generated water and thus Cal Water is able purchase this water. SFPUC has several sources of local water, including: Crystal Springs Reservoir, San Andreas Reservoir, Pilarcitos Reservoir, and Stone Dam Reservoir, all located in San Mateo County, and Calaveras Reservoir and San Antonio Reservoir, located in Alameda County. The maximum amount of local supplies specified in the WSA is 47,400 acre-feet per year (AFY) and is based on the amount of locally generated surface supply. This amount is slightly larger than Cal Water's ISG of 35.68 MGD.

Source water quality from SFPUC is generally excellent with constituents in its imported supplies, such as total dissolved solids, among the lowest in the state. There are occasional issues with algae blooms that can either result in algae or taste and odor problems in the distribution system. SFPUC switched to chloramines disinfection in 2004, to meet new regulatory requirements regarding of disinfection byproducts (DBPs) in the distribution system.

Skyline System

The following table summarizes the SFPUC turnout that supplies treated water to the Skyline System, and shows the location and delivery zone.

Table 5-1: SFPUC turnouts

Connection Number	Valve Number and Size	Location	Delivers to	Source	Total Capacity	SFPUC Connection number
BG-08	1-4"	Edmonds Road	Station 40 suction	Regional System	800 GPM (1.2 MGD)	28

Old La Honda System

Purchased water is supplied to the Old La Honda System by Station 45 (Upper Lake Tank). The source of that supply is from Pressure Zone 1025. The booster pumps at this station can supply the Old La Honda System with a flow capacity of 145 GPM.

Old La Honda System

SFPUC surface water supply is the only supply source for the Old La Honda System service area.

## 5.2 Review of Other Potential Sources of Supply

### 5.2.1 Groundwater

Both Skyline and Old La Honda System are located in the upper elevations of the Santa Cruz mountain range. As such, groundwater supplies are limited.

As mentioned previously, the Skyline System currently has an inactive well isolated from the hydraulic system and historically had an addition well prior to the acquisitions, but these wells can be artesian and may be classified as groundwater under direct influence of surface water.

Because of the aforementioned reasons, the section discussions of basin management, Sustainable Groundwater Management Act (SGMA) compliance, seawater intrusion, groundwater contamination, and groundwater water quality are not applicable.

### 5.2.2 Purchased Water

Cal Water currently has a 25-year Water Supply Agreement (WSA) with SFPUC was adopted in 2009 and will expire in 2034, with possible extensions to 2044. Cal Water has an allocation from the SFPUC, called the Individual Service Guarantee (ISG). The ISG can be distributed between the Bear Gulch and Bayshore (San Mateo, San Carlos, and South San Francisco systems) Districts at the company's discretion. Cal Water has purchased supply in excess of its ISG during years where there is no declaration of shortage by the SFPUC and additional supply is available. Normally, a penalty would be imposed for purchased supply in excess of ISG. In dry years, SFPUC supplies are allocated based on a computation stipulated to under the current contract.

### 5.2.3 Local Surface Water

There is no significant amount of surface water nor are there any available water rights to allow diversion of water from the surrounding creeks. Adjacent mutual water systems have small raw water

surface treatment plants but are facing increasingly stringent state and federal water quality regulation, requiring additional treatment processes to meet future regulations.

#### 5.2.4 Recycled Water

Implementation of a recycled water project in the Skyline or Old La Honda Systems is not feasible. Large potential customers are not available in these systems and source of recycled water is a considerable distance from the service area. These two reasons alone would make any type of project cost prohibitive.

#### 5.2.5 Exchanges or Transfers

Exchanges or transfers options are not available to Skyline or Old La Honda Systems alone, however to the greater Bear Gulch District, and Cal Water's Bayshore District, may be possible. This option will be examined more extensively when the Bear Gulch and Bayshore Master plans are updated in 2021.

#### 5.2.6 Desalinization

Desalinization option is not available to Skyline or Old La Honda Systems as access to potential seawater or saline bay water is a considerable distance from the service area.

### 5.3 Key issues that may impact these supplies

#### 5.3.1 Climate change effects on water sources

Cal Water has conducted a climate change study on all Districts. SFPUC and other local agencies have conducted and continue to study possible climate change effects. Based on these studies, climate change could result in the following types of water resources impacts, some of which are likely to affect the Tuolumne River watershed and local watersheds in the Bay Area:

- Reductions in the average Sierra Nevada annual snowpack due to a rise in the snowline elevation and a shallower snowpack at lower elevations, and a shift in snowmelt runoff to earlier in the year.
- Changes in the timing, intensity and variability of precipitation, and an increased amount of precipitation falling as rain instead of as snow.
- Long-term changes in watershed vegetation and increased incidence of wildfires that could affect water quality.
- Sea level rise and an increase in saltwater intrusion.
- Increased water temperatures with accompanying potential adverse effects on some fisheries and water quality.
- Increases in evaporation and concomitant increased irrigation need.
- Changes in urban and agricultural water demand.

#### 5.3.2 SWRCB Regulations

California State Water Resources Control Board (SWRCB) has been entrusted to preserve, enhance, and restore the quality of California's water resources and drinking water for the protection of the environment, public health, and all beneficial uses, and to ensure proper water resource allocation and efficient use, for the benefit of present and future generations. Within the SWRCB, Regional Water Quality Control Boards (Regional Boards) are responsible for regulating discharges to surface water and groundwater. The State Water Resources Control Board maintains compilations of various laws relevant

to different areas of the Regional Board's responsibilities including Water Quality Control Plans. The Skyline and Old La Honda Systems are part of the San Francisco Bay Region Basin Plan. The Basin Plan has been updated to reflect the Basin Plan amendments adopted up through May 4, 2017 and identifies water quality objectives for the region, but has not identified any specific objective for the Skyline and Old La Honda Systems.

## 6. Water System Evaluation

This section describes the water system analysis conducted for the Skyline and Old La Honda systems. The analysis includes: SFPUC turnout capacity evaluation; pumping capacity evaluation; storage capacity evaluation; pipeline system evaluation; supply reliability evaluation; and replacement guidelines.

The analysis is based on performance criteria described in this chapter. Section 7 describes Cal Water's asset management program. Section 8 presents the plan recommendations and the capital improvement program.

### 6.1 Overview of Performance and Design Criteria

Cal Water's standards for performance and design criteria are based on a combination of state mandated regulatory rules, industry association guidelines (e.g., American Water Works Association), current practices of similar water utilities and the experience of its own employees.

As a regulated water utility under the purview of the California Public Utilities Commission (CPUC), the primary regulatory requirements for performance and design criteria are identified in the CPUC's General Order 103. General Order 103 establishes "minimum standards to be followed in the design, construction, location, maintenance and operation of the facilities of water and wastewater utilities operating under the jurisdiction of the Commission."

The rules set forth in the order are a combination of standards for (1) minimum levels of service, intended to ensure that each utility operates its system so as to deliver reliable service to its customers, and (2) design and construction, intended to ensure that each utility's water system(s) conform to acceptable engineering standards and practices. Other regulatory requirements include the recently adopted revisions to the California Health and Safety Code Waterworks Standards (Chapter 16 of Title 22, California Code of Regulations).

These regulatory requirements, together with the other information sources noted above, provide the critical guidance and metrics to enable Cal Water to identify (1) the system reliability gaps and (2) the necessary capital improvements to ensure regulatory compliance and the delivery of reliable, high quality service to its customers at a reasonable cost. Cal Water's standards for performance and design criteria are summarized in Appendix E.

### 6.2 Demand Forecast Analysis

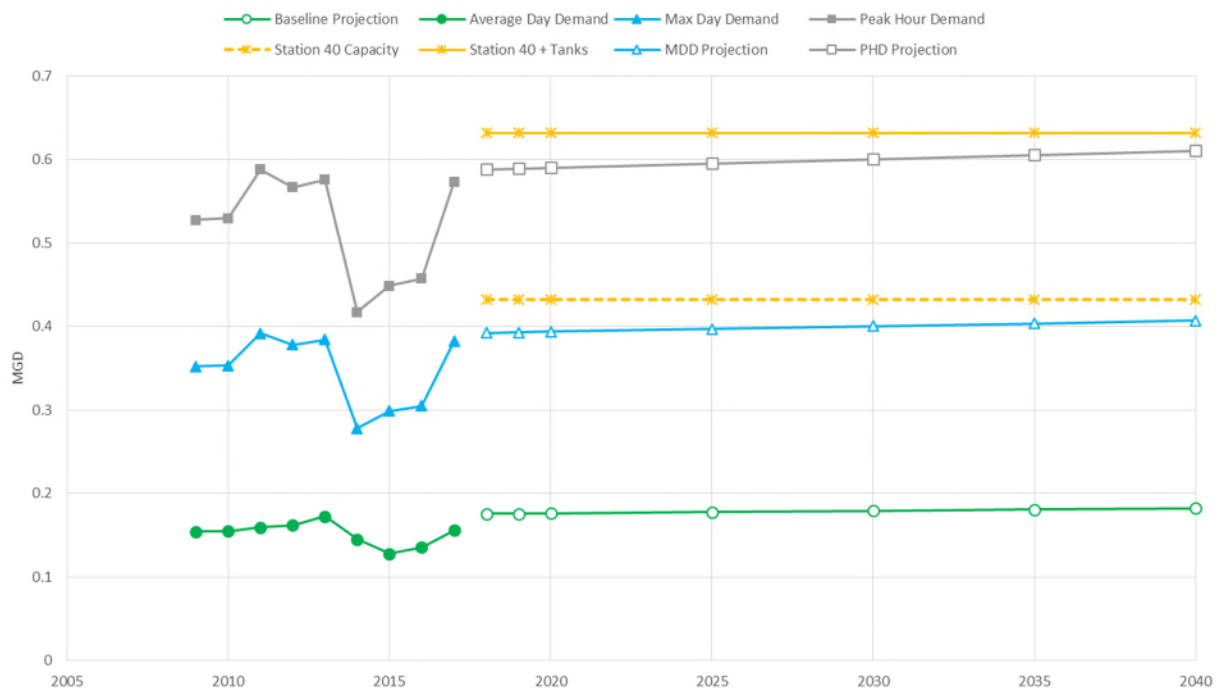
The demand forecast analysis was conducted by analyzing the system capacity as stipulated in the Title 22 Waterworks standards. The current system supply capacity was compared with current demands and projected demands. Graphs were developed to show the historical demands, along with projected demands through 2040, compared with available supply.

#### Skyline System

The following graph shows the historical for Average Day (green), Maximum Day (blue), and Peak Hour (grey) Demands. The projection from 2020 to 2040 is based on the anticipated demand as discussed in Chapter 4. The available supply is established based on the average flow as measured by the SCADA system.

The Average Day and the Maximum Day Demands can be met when compared to supply from Station 40 pumps. Utilizing one pump and designating one pump as backup, this station has a capacity of 300 gpm, or equivalent to 0.432 MGD. This capacity is designated as “Station 40 Capacity” in the graph. To meet Peak Hour Demand, available tank capacity is needed, consistent with Master Plan criteria. Using historical data from SCADA OSI/PI Historian, the calculated capacity from Station 041 is 101 gpm. From Station 042, an additional flow capacity of 44 gpm has been produced, based on the most recent historical records. Combining these values provide an additional supply capacity of 146 gpm or an equivalent of 0.210 MGD. This capacity is designated as “Station 40 + Tanks” in the graph. It should be noted that analysis to compute available tank capacity is based on average operating conditions, which is conservative.

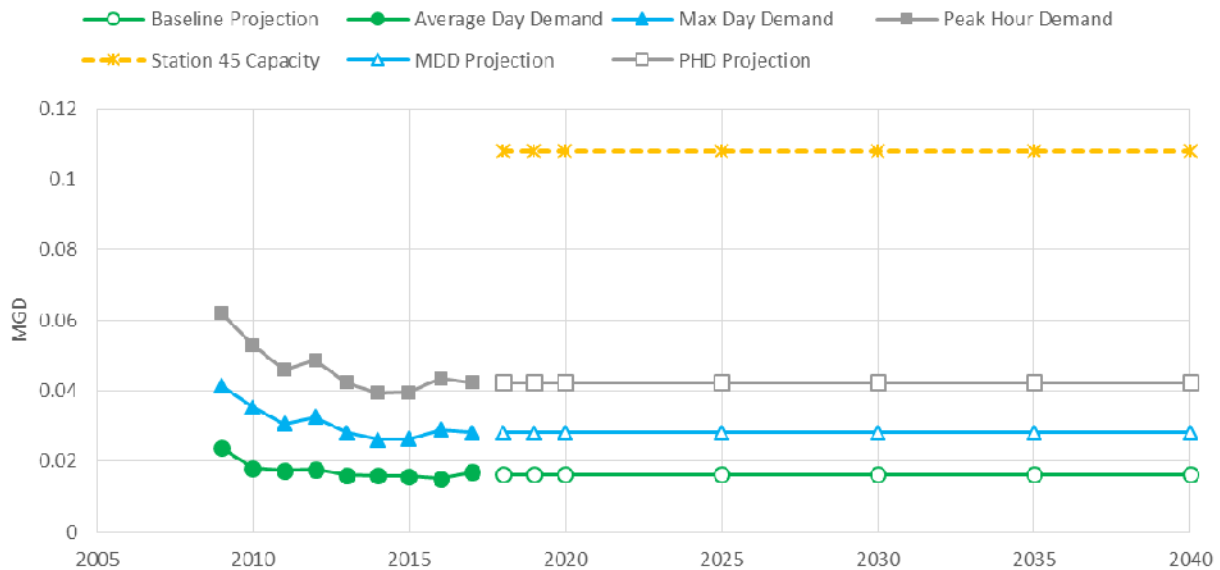
Figure 6-1: Skyline System Demand Forecast



### Old La Honda System

The following graph shows the historical for Average Day (green), Maximum Day (blue), and Peak Hour Demands (grey). The projection from 2020 to 2040 is based on the anticipated demand as discussed in Chapter 4. From Table 3-6, utilizing one pump and one pump as backup, this station has a capacity of 70 gpm, or equivalent to 0.108 MGD. As shown in the graph, all three demand conditions can be met with the capacity from Station 45.

Figure 6-2: Old La Honda System Demand Forecast



## 6.3 Storage Capacity Evaluation

The District uses water supplied from storage to help meet peak demands. In this section, District operational, emergency, and fire storage criteria are reviewed. Pumping and storage facilities are evaluated and sized to meet the District's requirements under demand conditions including maximum day, maximum day plus fire flow, and peak hour.

Distribution storage facilities are designed to provide the recommended volume of water to equalize the pumping rate of water supply facilities or booster stations during the projected peak demand event. The volume of water necessary for fire protection needs is also evaluated. The total storage capacity volume may be reduced by a system's production and supply facilities that have sufficient standby power equipment.

Storage facilities need to:

- Provide operational storage to supply peak hour demands.
- Provide fire storage and fire flow to meet fire flow requirements.
- Provide emergency storage.

In this analysis the total treated water storage capacity requirements is evaluated based on operational storage, fire storage, and emergency storage requirements per the District's standard operational and performance criteria in Appendix E of this plan.

### Skyline System

The Skyline System storage calculation are shown in Appendix F1. The calculation shows that the required storage for this system is 1.08 MG. With existing storage is 0.63 MG, there is a need for 0.45 MG of additional storage. The proposed new storage at Station 048 would provide an additional 0.26 MG of storage, still leaving a storage deficit of 0.19 MG. The remaining storage that is still required is proposed as a future project.

### Old La Honda System

A similar storage calculation was completed for the Old La Honda System as presented in Appendix F2. This system had the storage tanks replaced recently. Based on the available data for this system, the calculations show that this system has sufficient storage capacity.

## 6.4 Zone Supply Capacity Evaluation – Gap Analysis

The Gap Analysis evaluates whether there is sufficient water system supply capacity is required to meet different operating criteria, such as meeting maximum day demand and fire flow conditions. The Performance Criteria, Appendix E, under Pumping Facilities (GO103), discusses the criteria that Cal Water has established which includes to the following requirements:

- Zones with reservoir storage should provide firm pumping capacity or gravity supply capacity that is sufficient to meet maximum day demand. For zones with storage, fire reserves are provided from storage.
- Zones without storage in the zone should have firm pumping capacity or gravity supply capacity to meet the peak hour demand on the maximum day, plus a fire pump or other means of providing fire flows to the zone.
- For all zones, the pump station must also have the ability to pump any flow that would be lifted through to supply subsequent higher zones.
- Firm capacity is defined as the capacity with the largest pumping unit at the pump station out of service.

Spreadsheet models were developed to analyze the systems using mass balance calculations, comparing supply and demand for the entire system and individual pressure zones. Each identified pressure zone is isolated based on available pumps and storage and any cascading pressure zone dependent on the given pressure zone. The analysis attempts to identify if there is sufficient pump capacity and storage to meet the maximum historical 10-year demand under operational, fire flow, and emergency conditions. The analysis does not take into account transport capacity from one zone to another, which in some cases may benefit a supply/storage deficit

### Skyline System

A mass balance analysis, by zone, for operational, fire flow, and emergency conditions was completed for the Skyline System as shown in Appendix G1 with the demand distributed by zone as shown in following table.

Table 6-1: Skyline System Demand Distribution by Pressure Zones

Pressure Zone	2016	2017	Average
Total System	100.0%	100.0%	100.0%
Zone 2370 cascade w/o Zone 1610	36.7%	38.3%	37.5%
Zone 1610 cascade	63.3%	61.7%	62.5%

The calculation shows that for a total system analysis, there is sufficient pump and storage capacity to meet the maximum demand, based on analysis of demands for the last ten years. A similar conclusion can be made for 2370 zone without the 1610 and cascading zones. For the 1610 and the cascading zones, a deficiency is estimated under fire flow and emergency conditions. The calculations show a deficiency of 60,000 gals for fire flow conditions and 82,000 gals for emergency conditions, for a total of 142,000 gallon deficit. The proposed tank at Station 48, Skeggs Tank, will be located at a higher pressure zone, 2370, and may provide a cascade flow to the 1610 pressure zone, which will reduce the storage deficit requirement for this zone. Available flow capacity cannot be evaluated with the spreadsheet model. It should be evaluated once a hydraulic model is developed for the system. Additionally, limited available land at the 1610 pressure zone would constrain the development of supplemental storage at this pressure zone. A siting study to determine the development of supplemental storage at the 1610 pressure zone in the Skyline System.

#### Old La Honda System

A mass balance analysis by zone for operational, fire flow, and emergency conditions was completed for the Old La Honda System as shown in Appendix G2 with the demand distributed by zone as shown in following table.

Table 6-2: Old La Honda System Demand Distribution by Pressure Zones

Pressure Zone	2016	2017	Average
Total System	100.0%	100.0%	100.0%
1255	44.6%	42.1%	43.3%
1810	55.4%	57.9%	56.7%

The calculation shows that for a total system analysis, there is sufficient pump and storage capacity to meet the maximum demand for the last ten years. For both Zones 1255 and 1810, the analysis shows a deficiency under fire flow conditions. The calculations show a deficiency of 46,000 gals for the Zone 1255 and 19,000 gals for Zone 1810. Additional analysis is recommended to better determine the storage deficiency amount and investigate available options.



## 7. Asset Management Programs

This section discusses both the company-wide asset management program objectives, and specific objectives established for the Skyline and Old La Honda Systems.

### 7.1 Overview of Asset Management Program

Cal Water is committed to managing its infrastructure in order to provide safe and reliable water to its customers. In addition to the analysis of system operational reliability, Cal Water looks to its asset management program to identify capital projects necessitated by the need to replace facilities because of aging infrastructure.

### 7.2 Pump Replacement Program

An important component of Cal Water's asset management effort is the ongoing monitoring, evaluation and testing, and maintenance, modification or replacement of Cal Water's pumping equipment. Failure to do so can lead to declining efficiency, reliability and eventually unpredicted failure. These declines result in increased energy costs and risk to provide reliable service to Cal Water's customers.

Unpredicted failures can result in expensive emergency repairs and reliability; and even structural deterioration, collapse or complete failure of the groundwater production wells.

Ongoing monitoring, evaluation and testing of Cal Water's pumping equipment is key to maintaining the health of a systems ability to provide a safe and reliable water supply. Cal Water is dedicated to overseeing and providing technical assistance to the ongoing monitoring, evaluation and testing, and maintenance, modification or replacement of over 600 pumping equipment assets.

A pump is the heart of a water system. A pump increases water pressure and as a result moves a known volume of water from one point to another point. Pumping equipment is critical to the operation of a water system. The two main types of pumping equipment of concern are Booster Pumps and Groundwater Well Pumps (Well Pumps).

#### Booster Pumps

Booster pumps are used to add water volume, maintain system pressure, and move water through a system. Examples of booster pump include moving water from a storage tank and into the system; pushing water through a treatment vessel; and transferring water from one storage tank to a higher elevated storage tank. In some cases, tanks (storage and hydro pneumatic) maintain system pressure, but as system demand increases, pumps take over as the workhorse to balance the system's pressure.

#### Pumping Equipment Life Expectancy

The condition of a pump is a critical factor affecting overall productivity and reliability of a water system and continued service to customers. Under this justification, Cal Water has two pumping classification – Boosters and Groundwater Well Pumps. Over time, pumps become less efficient and reliable, and is directly dependent on the application and user – specifically, how the pump is installed, operated and maintained.

*Factors Affecting Pumping Equipment Life Expectancy*

There are multiple factors that affect the life expectancy of the pumping equipment. Factors affecting different types of pump's life expectancy that Cal Water may assess include:

- Monitoring
- Maintenance
- Radial Forces
- Suction Pressure
- Driver Alignment
- Pipe Strain
- Fluid Properties
- Operational Service
- NPSHA/R Margin
- Pump Speed
- Impeller Imbalance
- Pipe Geometry
- Suction Flow
- Declining Water Level
- Pump Placement

*Proactive and Planned Replacement*

To maintain optimal system reliability and operational efficiency, a proactive and planned approach to managing pumping equipment is the best management practice. Being proactive includes on-going monitoring and testing of the pumping equipment, evaluation of system data, and evaluate equipment design conditions before changes to the application are implemented. By taking a pro-active approach to managing its pumping system assets which enables the following:

- Provides sufficient time to analyze and design new assets to meet current and future demands
- Allows for the selection and procurement of the optimum materials, parts and equipment
- Enables advanced scheduling of the shutdown of the station which protects system reliability and redundancy

Ultimately, Cal Water customers receive reliable, consistent, and safe water service.

Proposed Projects Currently, there are no projects proposed for the Skyline System. However, the pumps at Station 40 are the critical supply of the Skyline System and will be under constant review using the factors listed above.

The following is a listing pump replacement projects proposed for the Old La Honda System.

Table 7-1: Table GRC Pump & Motor Replacement Projects

<i>PID</i>	<i>Location</i>	<i>Year Installed</i>	<i>Proposed Project Year</i>
115017	BG 043-A	Unknown	2021
115020	BG 043-B	Unknown	2021

### 7.3 Main Replacement Program

Another key element of Cal Water’s Asset Management program focuses on the evaluation and selection of those pipeline facilities that will be incorporated into Cal Water’s capital improvement program and eventual inclusion in the company’s general rate case application.

A critical component of this evaluation is the “consequence of failure” (COF) classification, which is used to help prioritize those sections of Cal Water’s distribution system for repair and replacement. This section describes the methods used to determine the COF classification, likelihood of failure and ultimately, the risk of each section of pipeline.

Each section of pipeline is provided a COF value based on pertinent attribute data. A Triple Bottom Line (TBL) approach is used to determine the COF value. The TBL ranks harm to people as the greatest consequence, followed by harm to the environment and then negative financial impacts. Each TBL level was assigned a factor consistent with its level of importance. This is consistent with Cal Water’s Strategic Framework. Using methods outlined by FEMA, the attributes given were identified as threats to acceptable levels of service. The TBL value for each is also listed.

Table 7-2: Leak Summary and Pipeline

Triple Bottom Line Level	TBL COF Value
Harm to people	5
Harm to environment	4
Negative financial impact	3
Large or trans. main	2
Minimal COF	1

Table 7-3: Leak Summary and Pipeline

Attribute	TBL COF Value
Airport Boundary	3
Airport Runway	3
Road A1A2	3
Road A3	3
Railroad	3
Backyard Easement	3
Emergency Center	5
Fire Station	5
Healthcare Facility	5
Police Station	5
School	5
Water	4
MPA	4
NWI	4
Delta Zone	4
Landslide Hazard	4

An additional factor has been added for large or transmission pipelines. Although the larger pipes tend to be more robust, their importance to the continuity of service had to be addressed. They were assigned a COF value of 2 to convey their importance.

Any pipeline that falls outside of the TBL or is not a large or transmission pipeline is assigned a 1 as their COF value. This means that there is generally a low consequence of failure for that particular pipeline.

#### Determining Likelihood of Failure

A key element in determining the overall risk of a pipeline asset is the Likelihood of Failure (LOF).

Many attempts have been made to develop predictive models for determining the LOF of pipelines. The results of these efforts have been largely inclusive, probably due to the large amount of variables. Completing comprehensive condition assessments for each pipe asset is cost and time prohibited. Typically the leakage rate has been used as an analog for the overall pipe condition; however, it should be noted that this is a reactive approach.

A combination of pipe age and leak count was used to develop the LOF values. Since using leak count as a surrogate for pipe condition is a reactive approach, a leak count of only two will escalate the pipe to a LOF value of 5. This conservative approach minimizes the reactivity of using leak count as condition. A single leak earns the value of a 4 since this could be the sign of a trend but could be a fluke. The remaining three values are deviated amongst pipe age ranges. The table below outlines the LOF values.

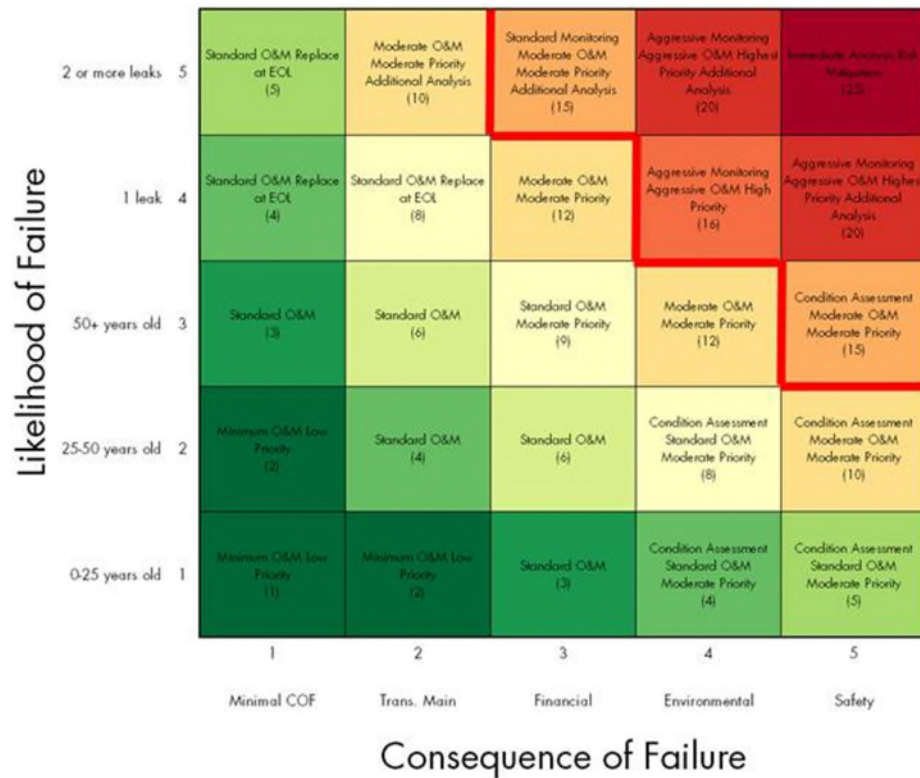
Table 7-4: LOF Description

LOF Description	TBL LOF Value
2 or more leaks	5
1 leak	4
Pipe age > 50 years	3
Pipe age = 25 – 50 years	2
Pipe age = 0 – 25 years	1

#### Determining Risk

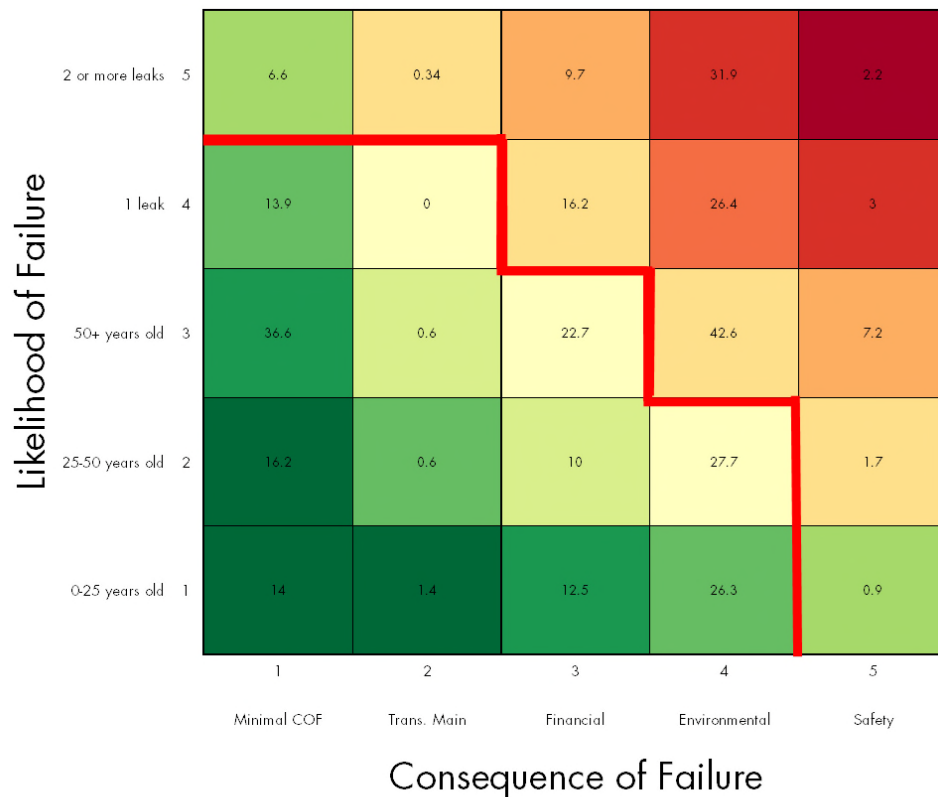
Once the COF and LOF values had been assigned to all pipes within the inventory, risk could be calculated. The risk was simply calculated by multiplying the COF and LOF values. This process returns risk values that range from 1 – 25. Each risk value has an appropriate business plan associated with it and is outlined in the 5x5 matrix below.

Figure 7-1: Pipeline Risk Assessment Plan



As can be seen in the risk matrix scorecard in the following figure, the age of the assets in the system is an even blend of new and old. Twenty percent of the system is piping with no leak history and a low consequence of failure. However, 44% of the system is considered moderate to high risk due to relatively high consequence of failure, relatively high likelihood of failure, or a combination of the two. Specific details on how risk is determined can be found in the common plant issues justification book.

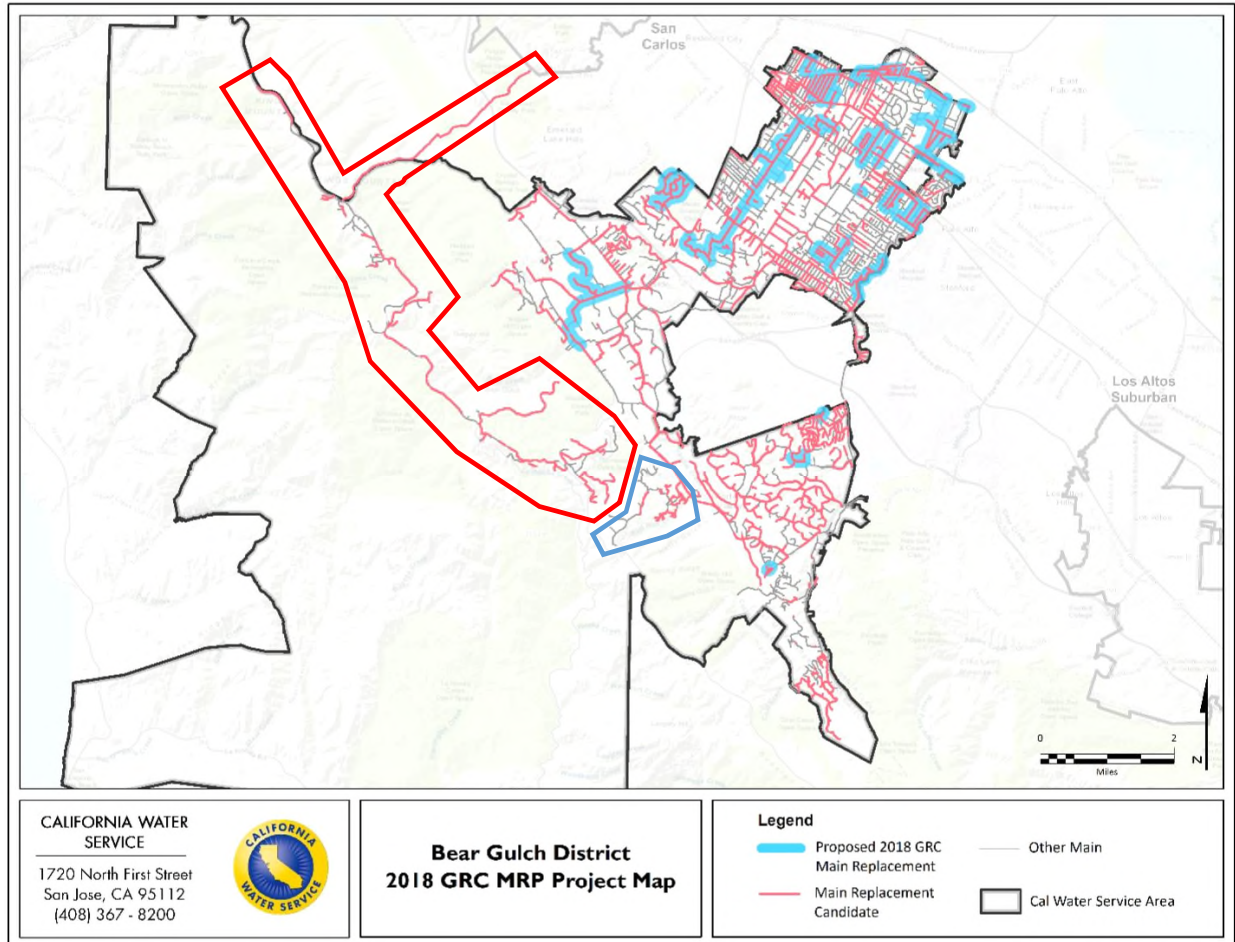
Figure 7-2: Bear Gulch Risk Scorecard



These high risk mains form the candidate list shown in red on the map in the following figure. It can be seen that the risk is well distributed across the system. The 2018 GRC project list (shown in blue) was selected with these inputs, with an effort to address equal parts of the system. Maps of projects are current as of 3/22/18, although as mentioned elsewhere, the list is re-evaluated every 90 days and are subject to revision based on changes in district needs and priorities. For more details on how these mains were selected, please refer to the Common Plant Issues justification book

Mains in red are moderate to high risk. Mains in blue are proposed replacement projects. Based on the analysis, all of the proposed replacement mains for the Skyline and Old La Honda Systems are candidate for future GRC's and no projects for these systems are proposed in the current GRC.

Figure 7-3: Bear Gulch Main Replacement Candidates and Proposed Projects.



Note: Date of project map: January 2018

Table 7-5: LOF Summary for Skyline and Old La Honda Systems

Final Risk Score	Skyline		Old La Honda	
25	-	-	-	-
20	12,472	9.0%	1,353	17.4%
16	18,760	13.6%	-	-
12	58,047	42.1%	-	-
9	9,897	7.2%	-	-
8	3,501	2.5%	-	-
6	205	0.1%	-	-
5	583	0.4%	-	-
4	8,124	5.9%	5,765	74.0%
3	18,830	13.7%	-	-
2	1,805	1.3%	-	-
1	5,598	4.1%	673	8.6%
<b>Total</b>	<b>137,824</b>	<b>100.0%</b>	<b>7,792</b>	<b>100.0%</b>

#### 7.4 Tank Maintenance Program - Retrofits

At Cal Water, tanks are defined as a vessel that is atmospherically vented through a roof, has a capacity of 5,000 gallons or greater and contains potable or non-potable water. The function of tanks vary greatly. They may provide storage, function as a forebay, maintain the hydraulic grade line of a pressure zone, or a variety of other functions. In most cases, tanks will provide multiple services rather than just one primary function. This capacity to serve in an assortment of duties makes tanks a vital component of the distribution system.

Given the importance of the tank infrastructure, it is vital that each tank is maintained to be reliable in all operating conditions. To maintain compliance with ever changing safety, environmental and water quality regulations, tanks must be retrofitted with new equipment and appurtenances. The scope of these retrofits can vary greatly.

The most common tank retrofit fall within the categories of: safety appurtenances (manways, ladders, roof landings, hatches, et cetera), seismic retrofits, overflow airgaps, flush cleanouts, vents, roof drains, or berms and swales.

Since all of the tanks in the Skyline and Old La Honda Systems have constructed within the last few years, Cal Water is not proposing any tank retrofit project

#### 7.5 Tank Maintenance Program - Coatings

One of the largest threats to tank reliability is corrosion. Corrosion can lead to leakage or complete infrastructure failure. There are several methods to reduce corrosion in tank however engineered protective coatings are by far the most efficient.

All of the identified projects have varying degrees of scope to address corrosion prevention improvement from deteriorated and/or failing coatings. For interior coatings, the work includes

complete removal of existing coatings, surface preparation of bare metal and installation of an NSF 61 approved coating material per Cal Water specifications. The coating area may include the complete interior or partial areas of the tank. For exterior coating of tanks, work either includes complete removal of existing coating similar to interior or spot repairing and over coating of existing paint systems with a modified new system. For all coating projects, some level of engineering controls need to be established to ensure work safety and protection, reduce environmental impacts and ensure ambient conditions are met for proper surface preparation, application and curing.

Cal Water inspects water storage tanks at five-year maximum intervals per standard industry practice. The purpose of the inspections is to evaluate the tank's structural integrity, the condition of the tank appurtenances and the effectiveness of the corrosion control systems: coatings, linings and cathodic protection systems. The inspection focuses on the storage tank substrate and structural integrity, the interior and exterior coating condition and proper functionality of all appurtenances. The assessment of the interior and exterior coating aims at identifying deficiencies and taking timely corrective action based on need by providing a condition rating of the failures or conditions associated with coatings on steel tanks: Rust, chalking, blistering/calcareous deposits, appearance and substrate condition which are used to determine the need and urgency for coating replacement. Information below is taken directly from Cal Water's Tank Engineering Tank Inspection Policy & Procedure.

Since all of the tanks in the have constructed within the last few years, Cal Water is not proposing any tank protective coatings projects at this time for the Skyline and Old La Honda Systems.

## 7.6 Hydraulic Modeling Strategic Plan

Hydraulic model development and maintenance is an industry necessity in holistically managing utility effectiveness, resilience, cost, customer satisfaction, and infrastructure performance. Additionally it provides:

- Defensible Capital Planning and Investment
- Operational Risk Mitigation
- Timely Emergency Response
- Water Quality Management
- Operational Optimization

Hydraulic modeling involves: model creation/maintenance, model updates, simulate/resolve operational issues, and validate infrastructure designs, fire protection analysis, water quality analyses, and unidirectional flushing sequence development.

The current model developed for the Bear Gulch District was developed in 2008 for the Master Plan and is currently categorized as limited for planning purposes. It does not include the Skyline and Old La Honda System as these systems have not been incorporated at that time.

Separate isolated models were being developed for the Skyline and Old La Honda Systems when it was decided to delay this effort because more value would be gained with a comprehensive model including the entire Bear Gulch District and the potential acquisition of the Skylonda System. Development of a comprehensive model will be pursued at a later time and be more cost effective and require less time for calibration.



## 8. Plan Recommendations/Capital Improvement Program

The following section identifies the current capital projects in the current 2108 General Rate Case and potential projects and studies for consideration in later GRCs.

### 8.1 Capital Project Planning

Cal Water uses a systematic, formalized approach to identify capital projects for GRCs. The company's thorough capital planning process includes eight milestones to identify the most important capital projects required to maintain and operate the water systems while meeting the regulatory requirements and customer needs. Based on the lessons learned from the 2015 GRC, Cal Water implemented certain improvements to the process with in the milestones for the 2018 GRC. The proposed projects were reviewed by district operations and the executive management multiple times to ensure that the capital needs and the customer affordability are balanced.

The following are the Capital Planning Process Milestones:

- **Develop Criteria & Analysis:** Conducted a conditional assessment of the existing assets and developed a project scoring system based on the physical condition, capacity, level of service reliability, and efficiency. Conducted supply demand analysis by hydraulic zone for each water system and identify water supply and storage needs. Generated further demand projections and compared them with the available supply to identify current and future water supply deficiencies. For this process, Cal Water calculated maximum day demands, storage volume requirements, and source capacities in accordance with Title 22 of the California Regulations and the guidelines stipulated in the AWWA manual. Water Quality analysis was conducted for all the ground water supply sources by creating Water Quality trending charts for the sources affected by various contaminants including regulated primary and secondary contaminants and non-regulated emerging contaminants to identify treatment projects needed to maintain highest water quality standards.
- **Create List of Problems:** A complete list of all the problems and possible solutions was created based on the water supply & water quality analysis, conditional assessment of the assets, and the operational needs for the next three rate cases. This step in the process required at least two meetings with each district to finalize a master list of projects.
- **District Kick-off Meetings:** Reviewed the initial list of problems and solutions and discussed the comprehensive Capital Improvement Plan for all the districts with subject matter experts from Engineering and Operations. Cal Water reviewed Operations optimization, safety projects and environmental compliance as part of this effort. These efforts included identifying the big picture scope and exploring projects and problems over 3 rate case cycles or 9 years of capital planning. This multiple rate case planning approach allowed for tight coordination of different components at any given location. For example, for some pump stations, piping, pump, electrical, routine asset replacements and structural issues were identified. This process allowed for consolidation of multiple projects into one all-inclusive project to optimize life cycle, construction impacts, and budget.
- **Create High Level Costs:** High-level costs were created for potential solutions to the identified problems to understand the cost impact of various alternatives.
- **Capital Impact Review:** A Capital Summit was organized that included a gathering of all the District Managers, Engineering Managers and Executive Officer Team to review the operational needs, proposed capital costs, and affordability of the customers. Balancing rate affordability of

our customers, Cal Water decided to defer some capital projects to the future and focus on the most important capital projects needed to maintain and operate the water systems.

- **Officer Review/ Approval:** The proposed projects and high-level budgets were presented to the at the Executive Management Committee meeting for approval and to proceed with creating detailed cost estimates and justifications for the selected projects.
- **Final Justifications:** Subject matter experts completed the justifications, and then Engineering and District Management reviewed the collated justification books for each district. The Capital Planning team also conducted a Quality Assurance/Quality Control check of the proposed projects and cost estimates.
- **Final Review & Approval:** Rate and revenue impacts were calculated based on the refined cost estimates and reviewed with the officer team. Project priorities were reviewed several times during this process in an attempt to achieve a balance between the operational needs and the rate affordability of the customers.

## 8.2 Current (2018) GRC Projects

The following is a summary of capital projects for the Skyline and Old La Honda systems submitted with the 2018 GRC.

Table 8-1: Listing of 2018 GRC Capital Projects

Project ID	Station or Location	System	Project Description	Year Start	Year Finish
114322	48	Skyline	BG Skyline Property Acquisition	2019	2021
116413	48	Skyline	BG Skeggs Tanks Construction	2020	2021
116421	Skyline Blvd.	Skyline/ Old La Honda	Skyline Old La Honda Main	2020	2021
114329	32/46	Old La Honda	Wayside Old La Honda Pipeline	2019	2019
115017	BG 043-A	Old La Honda	BG 43-A: Pump and Motor Replacement	2021	2021
115020	BG 043-B	Old La Honda	BG 43-B: Pump and Motor Replacement	2021	2021

Project ID 114322 is for the acquisition of property for the proposed water storage tanks, which will be identified as the Skeggs Tanks. This project is the precursor for project ID 116413, which is the construction of the proposed Tanks. The proposed project consists of three major components including:

1. Two new 130,000-gallon ground level welded storage tanks to be constructed at new station 48;
2. A new 1,300 lf of 8-inch ductile iron main (DI) to connect the two new tanks to an existing water main located along Skyline Boulevard; and
3. A new booster station including two new booster pumps, panelboard, generator, and hydropneumatic tank which will be added to existing Station 41. The booster pumps will create a new zone (2470) located south of Station 41.

Project ID 116421 is the Skyline Old La Honda Main which involves the connecting Zone 1810 (Old La Honda System) and Zone 1610 (Skyline System) with a new 5,850 foot 8-inch main along Skyline

Boulevard. The main transverses a neighboring water system, Skylonda Mutual Water System. Cal Water is currently in negotiations to purchase the Skylonda Mutual Water System. If this system is acquired, significant portions of the pipeline project could be eliminated.

Project ID 114329 is the Wayside Old La Honda Pipeline involves the installation of a new 8-inch transmission line to connect Station 32 Wayside Tank to Station 46 Orchard Hill (portion of old Old La Honda Mutual system). The current pipelines from Station 7 and 32 to Station 45 cross landslide areas which have failed on several occasions. The mains are location in steep terrain in Portola Valley on the eastern slopes of the Santa Cruz Mountains and have been developed in a way that isolates independent extremities off the main system network.

Project ID 115017 and 115020 are projects for pump and motor replacements at Station 043. These replacement are an important component of managing a water utility's infrastructure is the ongoing monitoring, evaluation and testing, and maintenance, modification or replacement of Cal Water's pumping equipment. Failure to do so can lead to declining efficiency, reliability and eventually unpredicted failure. These declines result in increased energy costs and risk to provide reliable service to Cal Water's customers. Unpredicted failures can result in expensive emergency repairs and reliability; and even structural deterioration, collapse or complete failure of the pumping equipment.

### 8.3 Future Projects

The projects identified in this section are derived from two main sources:

- 1) Analysis of the Cal Water system to meet the regulatory requirements (e.g., General Order 103)
- 2) Cal Water's Asset Management program to identify system infrastructure in need of repair and replacement.

#### Bear Gulch District WS&FMP Update

The main purpose of the WS&FMPs is to provide internal and external stakeholders an updated assessment of existing infrastructure and general direction on potential mid- and long-term infrastructure needs to (1) ensure that Cal Water maintains and improves its long-term operational reliability and (2) has a sufficient technical basis to support subsequent General Rate Case project justifications. Cal Water is developing a process of updating all WS&FMPs for each Cal Water District in a systematic and more efficient manner. The information provided in this Skyline and Old La Honda Systems WS&FMPs will be incorporated in the Bear Gulch Master Plan which is scheduled to occur within the next five years. A comprehensive hydraulic model would be suggested to model secondary supply point and flow reversal scenarios and potential rezoning of pressure zones in conjunction with the main replacement program to determine if any of the proposed main projects need to be upsized.

#### Edmonds Lift Study

The main supply line from Station 40 to the Skyline System main trunkline is a single 6" steel pipeline. This is a high pressure line due to the elevation difference between Stations 40 (300 feet above MSL) and Skyline Boulevard (2,350 feet above MSL). In addition, this main trunk line transverses the San Andreas Fault.

There has been consideration of dividing up the single lift into a series lift along the current pipeline alignment with the additional of booster stations and possible tanks. This part of the system used to operate as a series of in-line boosters (without tanks) when the system was operated SCWD. The

configuration was not desirable because it was difficult to coordinate control of the various pumping plants to prevent pump cavitation.

Cal Water has also approached a property owner along the right of way, whose property lies roughly 1/3 of the way along the pipeline route, about installing tanks and pumps on their property. Installation of the facilities would improve service reliability since they only receive water when Station 40 operates. The property would require access through a dirt road that may not be passable in the winter. Lack of winter access to the pipeline and any booster stations along its route will need to be considered in the design of supply delivery alternatives.

Because this mainline is the only pipe connecting the Station 40 with the Skyline System, a study is proposed to reevaluate the above examples and to investigate additional configuration to add additional reliability to this part of the Skyline System.

#### Edmonds Lift Emergency Action Plan

Until the Edmonds Lift Study is completed and a solution is enacted, and Emergency Action Plan should be developed as soon as possible to identify a detailed set of steps for the District to follow during a major rupture of the trunkline from Station 40 to the Skyline System.

#### Edmonds Lift Transient Analysis

During startup of Edmonds Pump Station, Station 040, air entrapment develops in the mainline to the Skyline System. The station includes Fischer pump control valves, which are non-standard to Cal Water. These are oil industry valves used for very high pressure. These valves are intended to eliminate surges by opening slowly on pump startup (the valve begins to open as the pump starts and continues opening for several seconds after the pump is running at full speed) and closing slowly before the pump shuts down. The air entrapment causes operation issues and customer complaints. A transient analysis would identify a cause of the problem and provide a recommendation for a solution.

#### Skyline Trunkline Inspection

The backbone of the distribution system is a mainline which traverses approximately 8½ miles along Skyline Boulevard. Part of this mainline is 4-inch diameter steel material and traverses forests and property with limited access for inspection. The Mainline Replacement Program has identified several sections of the mainline as a candidates for replacement; however, at present, current risk score was not sufficient to make this this trunkline a current replacement project. Until it has been replaced to current standards, a detailed inspection of the mainline is recommended to better define the risk score for these sections of mainline should be completed.

#### Station 44 Well to Skylonda Project

The possibility of getting supply from the well at Station 044 would benefit the customers for additional supply reliability and local supply, since the only supply to this system is SFPUC purchased water. The SFPUC supply can be offline for scheduled maintenance and the Skyline System needs to rely on its storage tanks during this time.

Cal Water is currently in negotiations to purchase the Skylonda Mutual Water System. If this system is acquired, the production of Well 044 can be delivered to the Skylonda surface treatment facilities. This would eliminate the cost of drilling a new well, and possibly a stand-alone treatment plant, but a potential of an increase in O&M costs. A detailed analysis of this alternative will be necessary including water quality and treatment type evaluation.

Well Siting Study

A well siting study would be valuable to identify potential well locations within the Skyline System as well as potential well yields. A well would significantly improve system reliability, by providing a new supply source in addition to SFPUC.

North Skyline System Storage

There are no storage tanks north of the Edmonds lift pipeline as it connects with the Skyline System. Any breaks in the trunkline north of this system would leave this portion of the system without water. This study would investigate potential locations and sizing of storage facilities.

Station 42 to 41 Reverse Flow Study

This study would investigate a means to move water from Station 42 up to Station 41 to reduce reliance on Station 40. This study will involve hydraulic modeling of multiple or a single lift options and pipeline reconfiguration to bypass zones.

Dead End Mains Study

Many locations in the Skyline System have mains leading into cul-de-sac and dead-end streets which prevent sufficient flows for water turnover, leading to taste and odor problems and other water quality issues. Flushing of these pipes also cause significant emptying of the storage facilities which result in unsafe operational conditions. This study would identify pipes located in dead ends and potential solutions such as pipe looping or additional pipe branching.

Low Pressure Analysis

The District has reported low pressure in the distribution system (Mountain Meadows area). Pressure at the higher elevations of the Mountain Meadows area drops below 40 psi when peak demand conditions coincide with the tank recovery at Station 42. Following are several alternatives that can be further explored to resolve the issue:

1. Install an additional storage tank in this the zone.
2. Increase the hydraulic grade of the southern part of this zone. A tank would be installed at an elevation sufficient to maintain pressure in the zone above 40 psi under all operational conditions.
3. Construct a pressure system to serve the area experiencing low pressure (Mountain Meadows).

The hydraulic model can be utilized to determine the extent of the low pressure and model potential solutions.

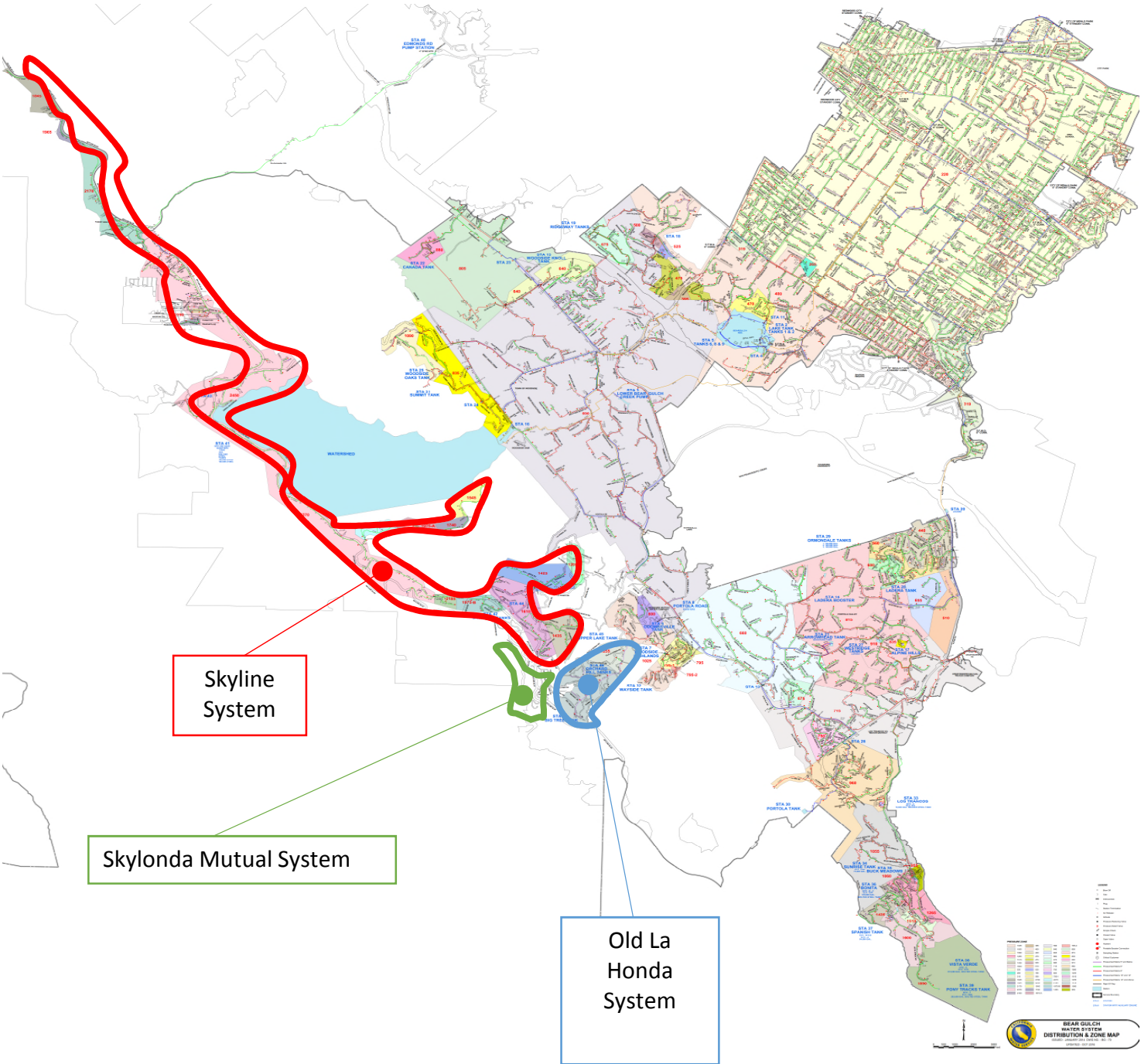


## Appendix A: Distribution, Zone Map, and Schematics

- Appendix A1: Bear Gulch District Distribution and Zone Map
- Appendix A2: Skyline System Schematics
- Appendix A3: Old Woodside System Schematics



Appendix A1: Bear Gulch District Water System Distribution and Zone Map





## Appendix A2: Skyline System Schematic





## Appendix A3: Old La Honda System Schematic





## Appendix B: Services, Sales, and Production Summary

- Appendix B1: Skyline System Services, Sales, and Production Summary
- Appendix B2: Old La Honda System Services, Sales, and Production Summary
- Appendix B3: Bear Gulch System (w/o Skyline and Old La Honda) Services, Sales, and Production Summary
- Appendix B4: Bear Gulch District Services, Sales, and Production Summary



## Appendix B1 Services, Sales, and Production (Skyline System)

**California Water Service Company - Skyline System****Water Supply and Demand Analysis and Projections****Summary Table**

Services	Class	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
	Code											
Single Family Res.	1	-	457	455	453	454	447	449	448	456	456	
Single Family Res (flat)	4	-	-	-	-	-	-	-	-	-	-	
Multi-Family Res.	15	-	-	1	2	1	1	1	1	1	1	
Commercial	2	-	11	11	11	11	11	10	10	11	11	
Industrial	3	-	-	-	-	-	-	-	-	-	-	
Irrigation	7	-	1	1	1	1	1	1	1	1	1	
Other	8	-	-	-	-	-	-	-	-	1	4	
Other	13	-	-	-	-	-	-	-	-	-	-	
Public Authorities	11	-	1	1	1	1	2	1	1	2	2	
<b>Total</b>		-	470	469	468	468	462	462	461	472	475	
Est. Number of MFR Units		-	-	2	2	2	2	2	2	2	2	
<b>Sales (kGals)</b>												
Single Family Res.	1	-	35,865	45,037	43,350	46,661	53,428	46,066	37,506	36,497	41,955	
Single Family Res (flat)	4	-	-	-	-	-	-	-	-	-	-	
Multi-Family Res.	15	-	-	-	1,354	1,322	1,241	1,227	1,167	1,422	984	
Commercial	2	-	2,690	7,658	3,982	4,486	6,323	4,725	3,517	5,207	5,414	
Industrial	3	-	-	-	-	-	-	-	-	-	-	
Irrigation	7	-	44	16	11	7	24	19	16	6	56	
Other	8	-	-	-	-	-	-	-	-	4	28	
Other	13	-	-	-	-	-	-	-	-	-	-	
Public Authorities	11	-	58	85	76	81	87	75	96	316	396	
<b>Total</b>		-	38,657	52,796	48,773	52,557	61,103	52,113	42,303	43,453	48,833	
NRW (kGals)			17,685	3,752	9,470	6,795	1,869	957	4,445	6,078	8,081	
NRW (%)			31.39%	6.63%	16.26%	11.45%	2.97%	1.80%	9.51%	12.27%	14.20%	
		366	365	365	365	366	365	365	365	366	365	365
<b>Supply (kGals)</b>												
Purchased		55,712	56,342	56,548	58,243	59,352	62,972	53,070	46,748	49,531	56,914	
Surface		-	-	-	-	-	-	-	-	-	-	
<b>Total</b>		55,712	56,342	56,548	58,243	59,352	62,972	53,070	46,748	49,531	56,914	
Purchased		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
Surface		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
<b>Demand per Service (gal/serv/day)</b>												
Single Family Res.	1	-	215	271	262	281	327	281	229	219	252	
Single Family Res (flat)	4	-	-	-	-	-	-	-	-	-	-	
Multi-Family Res.	15	-	-	-	2,120	3,612	3,400	3,361	3,197	3,885	2,697	
Commercial	2	-	670	1,907	992	1,114	1,575	1,295	964	1,293	1,348	
Industrial	3	-	-	-	-	-	-	-	-	-	-	
Irrigation	7	-	121	43	31	20	66	53	45	16	154	
Other	8	-	-	-	-	-	-	-	-	11	19	
Other	13	-	-	-	-	-	-	-	-	-	-	
Public Authorities	11	-	158	234	209	221	119	205	262	432	542	
NRW		-	103	22	55	40	11	6	26	35	47	
<b>Combined</b>		-	329	330	341	347	373	315	278	287	328	
MFR Unit Demand (gal/unit/day)		-	-	-	-	-	-	-	-	-	-	
<b>Demands (MGD)</b>												
MAD (Min Average Day)												
ADD		0.152	0.154	0.155	0.160	0.162	0.173	0.145	0.128	0.135	0.156	
MDD		0.347	0.352	0.353	<b>0.392</b>	0.378	0.384	0.278	0.299	0.305	0.382	
PHD		0.521	0.528	0.530	0.588	0.567	0.576	0.417	0.449	0.458	0.573	
Ratio (MDD/ADD)		2.28	2.28	2.28	2.46	2.33	2.23	1.91	2.33	2.25	2.45	
<b>Per Capita Demand (gpcpd)</b>												
Population		-	986	988	987	984	970	974	972	989	989	
Gross		-	156.5	156.9	161.7	164.8	177.9	149.3	131.8	136.8	157.6	
Residential		-	99.6	124.9	124.1	133.2	154.4	133.0	109.0	104.7	118.9	

Notes:



## Appendix B2: Services, Sales, and Production (Old La Honda System)

**California Water Service Company - Old La Honda System****Water Supply and Demand Analysis and Projections****Summary Table**

Summary Table		Class											
Services	Code	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
Single Family Res.	1	-	47	47	47	47	43	44	44	45	44		
Single Family Res (flat)	4	-	-	-	-	-	-	-	-	-	-		
Multi-Family Res.	15	-	-	1	1	1	1	1	1	1	1		
Commercial	2	-	-	-	-	-	-	-	-	-	-		
Industrial	3	-	-	-	-	-	-	-	-	-	-		
Irrigation	7	-	-	-	-	-	-	-	-	-	-		
Other	8	-	-	-	-	-	-	-	-	-	-		
Other	13	-	-	-	-	-	-	-	-	-	-		
Public Authorities	11	-	-	-	-	-	-	-	-	-	-		
Total		-	47	48	48	48	44	45	45	46	45	-	
Est. Number of MFR Units		-	-	2	2	2	2	2	2	2	2		
<b>Sales (kGals)</b>													
Single Family Res.	1	7,027	8,278	6,204	5,366	5,826	4,973	4,981	4,965	4,848	5,421		
Single Family Res (flat)	4	-	-	-	-	-	-	-	-	-	-		
Multi-Family Res.	15	-	-	102	591	459	558	591	564	374	378		
Commercial	2	-	-	-	-	-	-	-	-	-	-		
Industrial	3	-	-	-	-	-	-	-	-	-	-		
Irrigation	7	-	-	-	-	-	-	-	-	-	-		
Other	8	-	-	-	-	-	-	-	-	-	-		
Other	13	-	-	-	-	-	-	-	-	-	-		
Public Authorities	11	-	-	-	-	-	-	-	-	-	-		
Total		7,027	8,278	6,306	5,957	6,285	5,531	5,571	5,529	5,222	5,799		
NRW (kGals)		374	423	301	421	205	346	244	259	325	401		
NRW (%)		5.06%	4.86%	4.55%	6.60%	3.16%	5.88%	4.20%	4.47%	5.85%	6.47%		
		366	365	365	365	366	365	365	365	366	365	365	
<b>Supply (kGals)</b>													
Purchased		7,401	8,701	6,607	6,378	6,491	5,877	5,815	5,788	5,547	6,200		
Surface		-	-	-	-	-	-	-	-	-	-		
Total		7,401	8,701	6,607	6,378	6,491	5,877	5,815	5,788	5,547	6,200		
Purchased			100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%		
Surface			0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		
<b>Demand per Service (gal/serv/day)</b>													
Single Family Res.	1	-	483	363	313	339	317	310	309	294	338		
Single Family Res (flat)	4	-	-	-	-	-	-	-	-	-	-		
Multi-Family Res.	15	-	-	281	1,619	1,255	1,529	1,619	1,545	1,022	1,035		
Commercial	2	-	-	-	-	-	-	-	-	-	-		
Industrial	3	-	-	-	-	-	-	-	-	-	-		
Irrigation	7	-	-	-	-	-	-	-	-	-	-		
Other	8	-	-	-	-	-	-	-	-	-	-		
Other	13	-	-	-	-	-	-	-	-	-	-		
Public Authorities	11	-	-	-	-	-	-	-	-	-	-		
NRW		-	25	17	24	12	22	15	16	19	24		
Combined		-	507	378	364	369	366	354	352	329	377		
MFR Unit Demand (gal/unit/day)		-	-	-	-	-	-	-	-	-	-		
<b>Demands (MGD)</b>													
MAD (Min Average Day)													
ADD		0.020	0.024	0.018	0.017	0.018	0.016	0.016	0.016	0.015	0.017		
MDD		0.034	0.041	0.035	0.031	0.033	0.028	0.026	0.026	0.029	0.028		
PHD		0.051	0.062	0.053	0.046	0.049	0.042	0.039	0.040	0.043	0.042		
Ratio (MDD/ADD)		1.68	1.73	1.95	1.75	1.83	1.75	1.65	1.66	1.91	1.66		
<b>Per Capita Demand (gpcpd)</b>													
Population		-	101	105	105	105	97	99	99	101	99		
Gross		-	235.9	172.4	165.9	168.3	166.4	161.1	160.3	150.0	171.8		
Residential		-	224.4	164.6	154.9	163.0	156.6	154.3	153.2	141.2	160.6		

Notes:



## Appendix B3: Services, Sales, and Production (Bear Gulch System (w/o Skyline and Old La Honda))

**California Water Service Company - Bear Gulch System (w/o Skyline and Woodside)****Water Supply and Demand Analysis and Projections****Summary Table**

Services	Class	Code	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Single Family Res.	1		16,260	16,024	16,279	16,357	16,384	16,397	16,451	16,478	16,467	16,460	
Single Family Res (flat)	4		-	-	-	-	-	-	-	-	-	-	
Multi-Family Res.	15		70	76	73	80	82	83	83	112	173	183	
Commercial	2		1,326	1,353	1,354	1,348	1,340	1,339	1,339	1,316	1,261	1,250	
Industrial	3		1	1	1	1	1	1	1	1	1	1	
Irrigation	7		8	6	6	7	6	7	7	7	7	7	
Other	8		30	27	23	24	26	34	26	22	25	31	
Other	13		2	1	1	1	1	1	1	1	1	1	
Public Authorities	11		107	115	115	117	117	115	118	118	117	115	
<b>Total</b>			<b>17,804</b>	<b>17,603</b>	<b>17,852</b>	<b>17,934</b>	<b>17,958</b>	<b>17,976</b>	<b>18,025</b>	<b>18,054</b>	<b>18,052</b>	<b>18,050</b>	<b>-</b>
Est. Number of MFR Units			5,499	5,669	5,835	6,005	6,175	6,345	6,515	6,685	6,855	6,855	
<b>Sales (kGals)</b>													
Single Family Res.	1		4,103,831	3,726,747	3,412,370	3,365,690	3,589,327	3,843,412	3,485,690	2,687,037	2,566,013	2,885,434	
Single Family Res (flat)	4		-	-	-	-	-	-	-	-	-	-	
Multi-Family Res.	15		75,129	79,591	75,555	73,533	72,629	74,035	69,733	70,828	74,703	84,676	
Commercial	2		472,236	433,565	418,903	423,892	423,558	419,810	390,346	343,502	314,242	335,957	
Industrial	3		1,709	1,908	1,377	1,275	1,660	1,531	1,044	516	638	701	
Irrigation	7		12,379	9,258	10,501	8,215	9,077	8,516	7,741	8,362	7,893	8,391	
Other	8		7,442	9,638	3,313	2,971	2,654	3,671	4,700	4,779	6,577	4,360	
Other	13		8,550	3,696	3,095	3,489	3,683	4,746	4,376	3,187	3,443	3,817	
Public Authorities	11		110,377	104,746	96,537	98,753	104,624	120,711	93,611	71,642	70,825	94,666	
<b>Total</b>			<b>4,791,651</b>	<b>4,369,148</b>	<b>4,021,651</b>	<b>3,977,818</b>	<b>4,207,212</b>	<b>4,476,432</b>	<b>4,057,241</b>	<b>3,189,853</b>	<b>3,044,334</b>	<b>3,418,001</b>	
NRW (kGals)			199,337	207,407	190,672	275,009	132,118	281,625	179,021	146,822	193,391	231,928	
NRW (%)			4.2%	4.7%	4.7%	6.9%	3.1%	6.3%	4.4%	4.6%	6.4%	6.8%	
			366	365	365	365	366	365	365	365	366	365	365
<b>Supply (kGals)</b>													
Purchased			4,818,777	4,343,250	3,789,621	3,820,337	4,122,838	4,574,399	4,236,262	3,194,289	2,991,196	3,291,653	
Surface			172,212	233,305	422,702	432,490	216,492	183,658	-	142,385	246,529	358,276	
<b>Total</b>			<b>4,990,989</b>	<b>4,576,555</b>	<b>4,212,323</b>	<b>4,252,827</b>	<b>4,339,330</b>	<b>4,758,057</b>	<b>4,236,262</b>	<b>3,336,674</b>	<b>3,237,725</b>	<b>3,649,929</b>	
Purchased			96.5%	94.9%	90.0%	89.8%	95.0%	96.1%	100.0%	95.7%	92.4%	90.2%	
Surface			3.5%	5.1%	10.0%	10.2%	5.0%	3.9%	0.0%	4.3%	7.6%	9.8%	
<b>Demand per Service (gal/serv/day)</b>													
Single Family Res.	1		690	637	574	564	599	642	581	447	426	480	
Single Family Res (flat)	4		-	-	-	-	-	-	-	-	-	-	
Multi-Family Res.	15		2,919	2,882	2,820	2,508	2,422	2,454	2,304	1,735	1,182	1,265	
Commercial	2		973	878	848	861	864	859	798	715	681	736	
Industrial	3		4,668	5,226	3,773	3,492	4,535	4,195	2,859	1,414	1,743	1,920	
Irrigation	7		4,059	4,113	4,603	3,463	3,916	3,500	3,142	3,353	3,081	3,284	
Other	8		688	993	398	343	276	297	498	602	716	381	
Other	13		11,213	10,126	8,481	9,559	10,064	13,004	11,989	8,731	9,406	10,456	
Public Authorities	11		2,821	2,501	2,308	2,312	2,435	2,870	2,183	1,667	1,656	2,249	
NRW			735	680	617	608	640	682	617	484	461	519	
<b>Combined</b>			<b>766</b>	<b>712</b>	<b>646</b>	<b>650</b>	<b>660</b>	<b>725</b>	<b>644</b>	<b>506</b>	<b>490</b>	<b>554</b>	
MFR Unit Demand (gal/unit/day)			-	-	-	-	-	-	-	-	-	-	
<b>Demands (MGD)</b>													
MAD (Min Average Day)													
ADD			13.637	12.539	11.541	11.652	11.856	13.036	11.606	9.142	8.846	10.000	
MDD			22.971	21.734	22.532	20.444	21.749	22.862	19.145	15.200	16.927	16.613	
PHD			34.456	32.601	33.798	30.667	32.623	34.293	28.717	22.800	25.391	24.919	
<b>Per Capita Demand (gpcpd)</b>													
Population			55,791	55,397	56,161	56,784	57,286	57,745	58,314	58,813	59,217	59,631	
Gross			244.4	226.3	205.5	205.2	207.0	225.7	199.0	155.4	149.4	167.7	
Residential			204.7	188.2	170.2	165.9	174.7	185.9	167.0	128.5	121.8	136.5	

Notes:



## Appendix B4: Services, Sales, and Production - (Bear Gulch District (Consolidated))

**California Water Service Company - Bear Gulch District (Consolidated)****Water Supply and Demand Analysis and Projections****Summary Table**

Services	Class	Code	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Single Family Res.	1		16,260	16,528	16,781	16,857	16,884	16,887	16,944	16,970	16,968	16,960	
Single Family Res (flat)	4		-	-	-	-	-	-	-	-	-	-	
Multi-Family Res.	15		70	76	75	83	84	85	85	114	175	185	
Commercial	2		1,326	1,364	1,365	1,359	1,351	1,350	1,349	1,326	1,272	1,261	
Industrial	3		1	1	1	1	1	1	1	1	1	1	
Irrigation	7		8	7	7	8	7	8	8	8	8	8	
Other	8		30	27	23	24	26	34	26	22	26	35	
Other	13		2	1	1	1	1	1	1	1	1	1	
Public Authorities	11		107	116	116	118	117	119	119	119	119	117	
<b>Total</b>			<b>17,804</b>	<b>18,095</b>	<b>18,369</b>	<b>18,450</b>	<b>18,473</b>	<b>18,481</b>	<b>18,532</b>	<b>18,560</b>	<b>18,569</b>	<b>18,570</b>	
Est. Number of MFR Units			5,499	5,669	5,839	6,009	6,179	6,349	6,519	6,689	6,859	6,859	
<b>Sales (kGals)</b>													
Single Family Res.	1		4,110,858	3,770,889	3,463,611	3,414,406	3,641,814	3,901,813	3,536,737	2,729,508	2,607,358	2,932,810	
Single Family Res (flat)	4		-	-	-	-	-	-	-	-	-	-	
Multi-Family Res.	15		75,129	79,591	75,657	75,477	74,410	75,834	71,551	72,559	76,499	86,038	
Commercial	2		472,236	436,255	426,561	427,874	428,044	426,133	395,071	347,020	319,450	341,370	
Industrial	3		1,709	1,908	1,377	1,275	1,660	1,531	1,044	516	638	701	
Irrigation	7		12,379	9,302	10,517	8,226	9,084	8,540	7,760	8,378	7,899	8,447	
Other	8		7,442	9,638	3,313	2,971	2,654	3,671	4,700	4,779	6,581	4,389	
Other	13		8,550	3,696	3,095	3,489	3,683	4,746	4,376	3,187	3,443	3,817	
Public Authorities	11		110,377	104,803	96,623	98,829	104,705	120,797	93,686	71,738	71,141	95,061	
<b>Total</b>			<b>4,798,616</b>	<b>4,416,038</b>	<b>4,080,753</b>	<b>4,032,524</b>	<b>4,265,794</b>	<b>4,543,066</b>	<b>4,114,925</b>	<b>3,237,685</b>	<b>3,100,027</b>	<b>3,472,633</b>	
NRW (kGals)			255,486	225,559	194,725	284,924	139,379	283,840	180,222	151,525	192,776	240,410	
NRW (%)			5.06%	4.86%	4.55%	6.60%	3.16%	5.88%	4.20%	4.47%	5.85%	6.47%	
			366	365	365	365	366	365	365	365	366	365	
<b>Supply (kGals)</b>													
Purchased			4,881,890	4,408,292	3,852,776	3,884,958	4,188,681	4,643,248	4,295,147	3,246,825	3,046,274	3,354,767	
Surface			172,212	233,305	422,702	432,490	216,492	183,658	-	142,385	246,529	358,276	
<b>Total</b>			<b>5,054,102</b>	<b>4,641,597</b>	<b>4,275,478</b>	<b>4,317,448</b>	<b>4,405,173</b>	<b>4,826,906</b>	<b>4,295,147</b>	<b>3,389,210</b>	<b>3,292,803</b>	<b>3,713,043</b>	
Purchased			96.6%	95.0%	90.1%	90.0%	95.1%	96.2%	100.0%	95.8%	92.5%	90.4%	
Surface			3.4%	5.0%	9.9%	10.0%	4.9%	3.8%	0.0%	4.2%	7.5%	9.6%	
<b>Demand per Service (gal/serv/day)</b>													
Single Family Res.	1		691	625	565	555	589	633	572	441	420	474	
Single Family Res (flat)	4		-	-	-	-	-	-	-	-	-	-	
Multi-Family Res.	15		2,919	2,882	2,748	2,489	2,423	2,454	2,308	1,746	1,197	1,271	
Commercial	2		973	876	856	862	866	865	802	717	686	741	
Industrial	3		4,668	5,226	3,773	3,492	4,535	4,195	2,859	1,414	1,743	1,920	
Irrigation	7		4,059	3,556	3,974	3,005	3,385	3,052	2,743	2,930	2,698	2,893	
Other	8		688	993	398	343	276	297	498	602	689	340	
Other	13												
Public Authorities	11		2,821	2,481	2,290	2,295	2,416	2,823	2,166	1,655	1,636	2,220	
NRW			39	34	29	42	21	42	27	22	28	35	
<b>Combined</b>			<b>776</b>	<b>703</b>	<b>638</b>	<b>641</b>	<b>652</b>	<b>716</b>	<b>635</b>	<b>500</b>	<b>485</b>	<b>548</b>	
MFR Unit Demand (gal/unit/day)			37.3	38.5	35.5	34.4	32.9	32.7	30.1	29.7	30.5	34.4	
<b>Demands (MGD)</b>													
MAD (Min Average Day)													
ADD			13.809	12.717	11.714	11.829	12.036	13.224	11.768	9.286	8.997	10.173	
MDD			23.261	22.043	22.870	20.755	22.079	23.193	19.411	15.439	17.215	16.900 est	
PHD			34.892	33.065	34.305	31.133	33.119	34.790	29.117	23.159	25.823	25.350	
Ratio (MDD/ADD)			1.68	1.73	1.95	1.75	1.83	1.75	1.65	1.66	1.91	1.66	
<b>Per Capita Demand (gpcpd)</b>													
Population			55,791	56,484	57,254	57,876	58,376	58,812	59,387	59,883	60,307	60,719	
Gross			247.5	225.1	204.6	204.4	206.2	224.9	198.2	155.1	149.2	167.5	
Residential			205.0	186.8	169.4	165.2	173.9	185.3	166.5	128.2	121.6	136.2	

Notes:

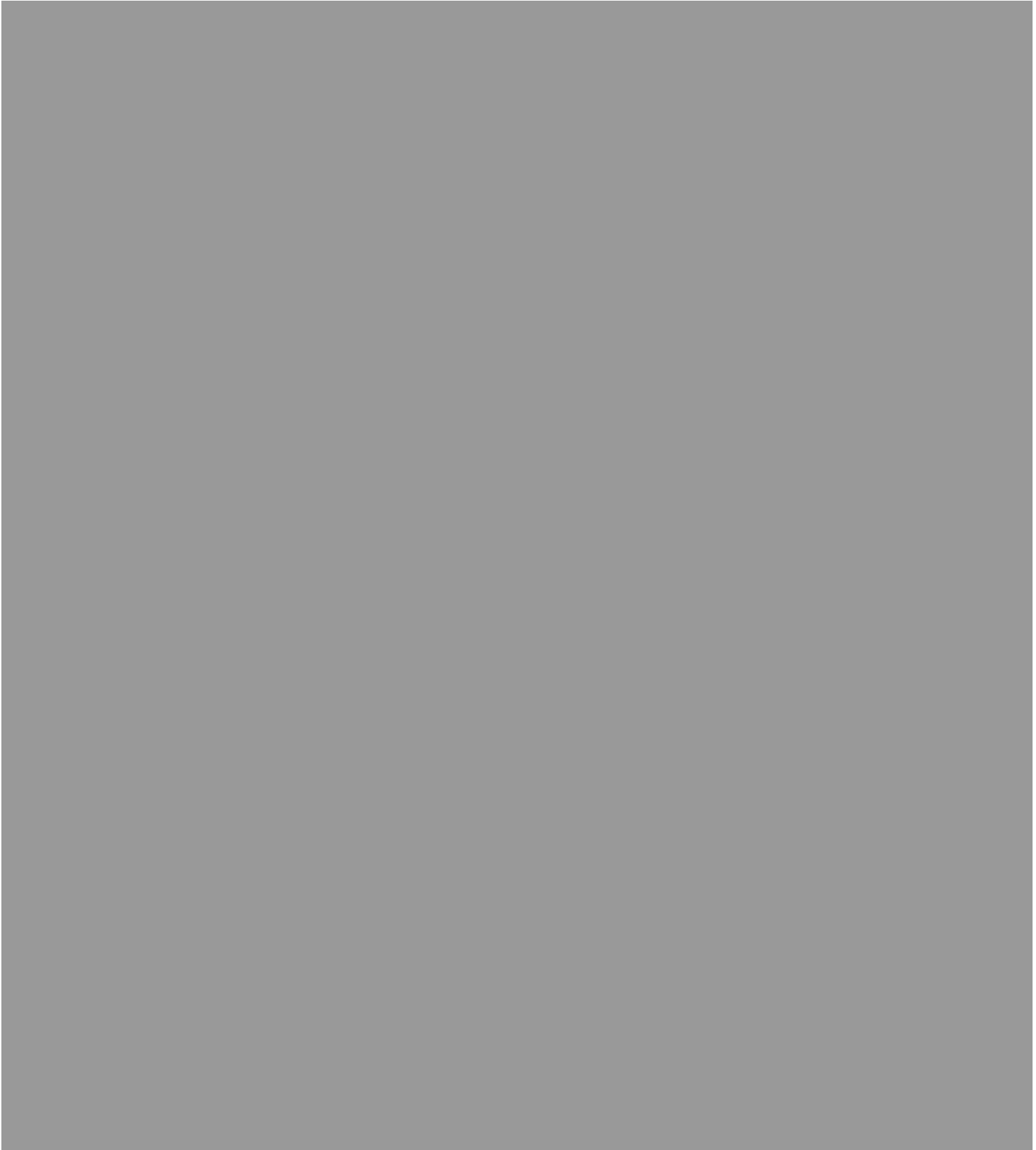


## Appendix C: Skyline and Old Woodside System Distribution and Zone Map

- Appendix C1: Skyline System Distribution and Zone Map
- Appendix C2: Old Woodside System Distribution and Zone Map



## Appendix C1: Skyline System Water System Distribution and Zone Map





## Appendix C2: Old La Honda System Water System Distribution and Zone Map





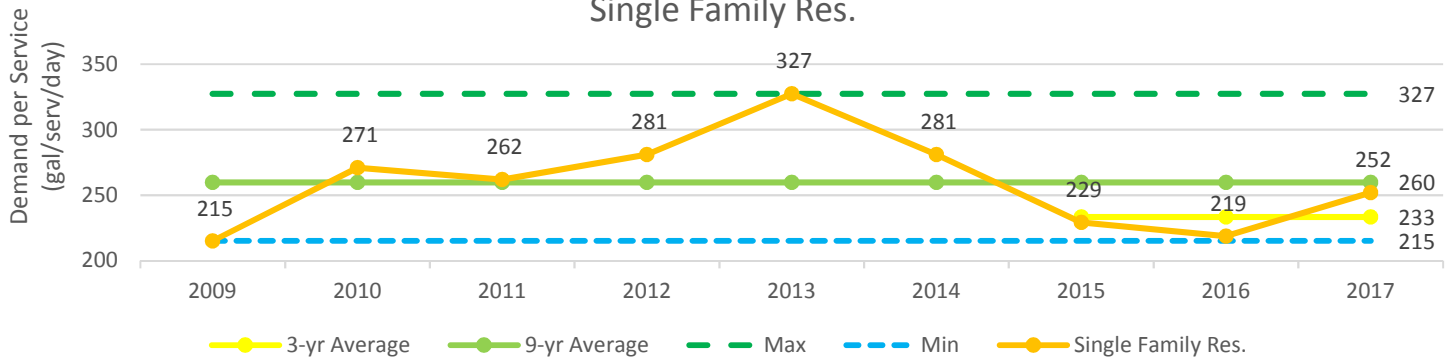
## Appendix D: System Demand per Service

- Appendix D1: Skyline System Demand per Service
- Appendix D2: Old La Honda System Demand per Service

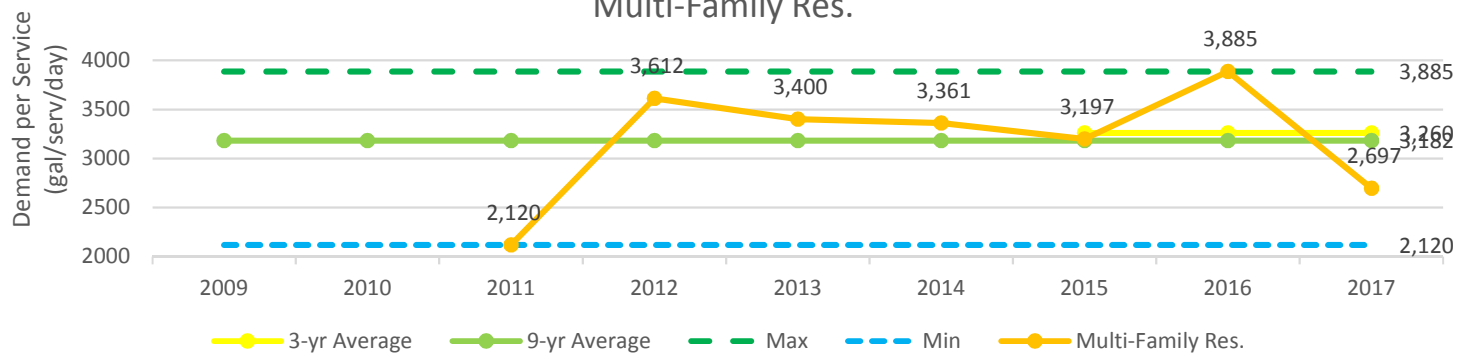


## Appendix D1: Skyline System Demand Per Service (SFR, MFR, COM, IRRI) 1/2

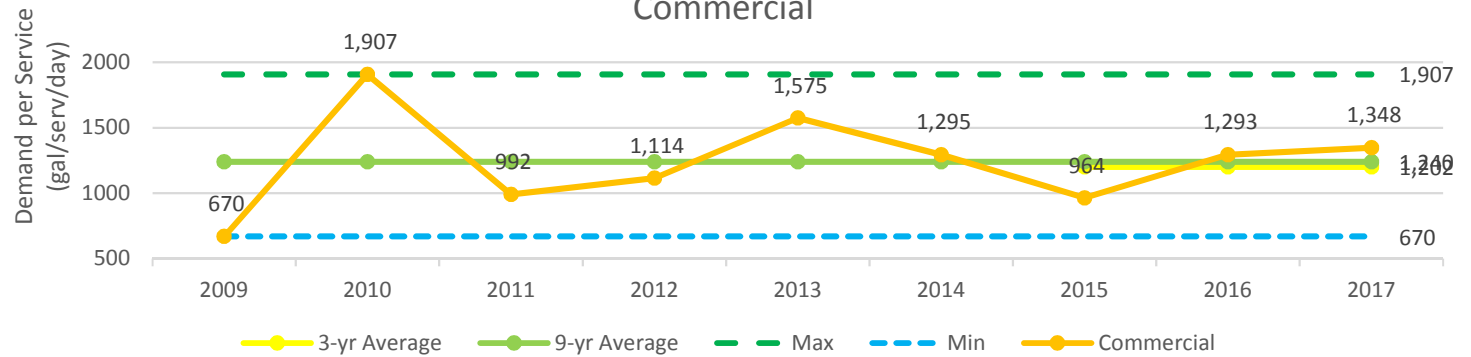
## Single Family Res.



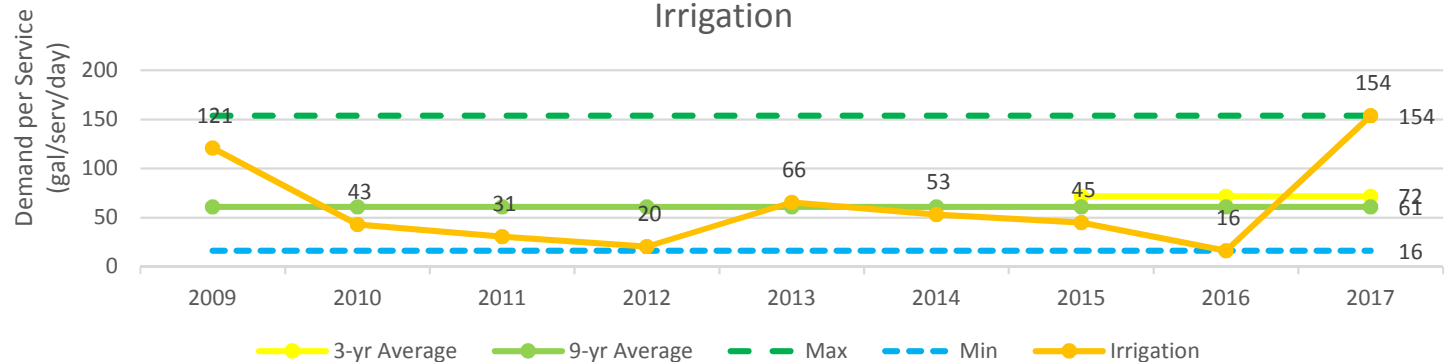
## Multi-Family Res.



## Commercial

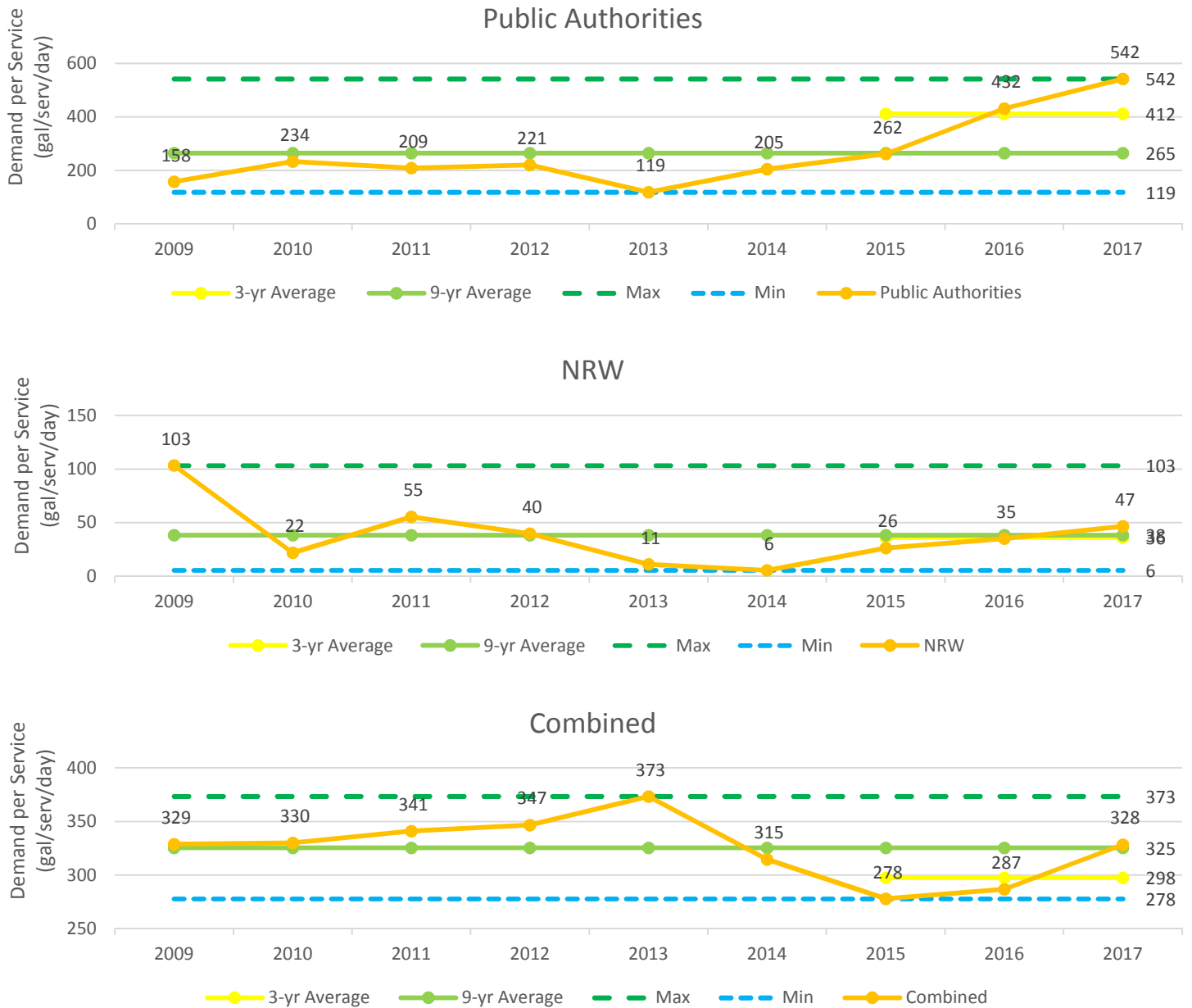


## Irrigation





## Appendix D1: Skyline System Demand Per Service (Public, NRW, Combined) 2/2





## Appendix D2: Old La Honda System Demand Per Service (SFR, MFR, NRW, Combined)





## Appendix E: Performance Criteria

- Appendix E1: Performance Criteria
- Appendix E2: Supply to Distribution System
- Appendix E3: Distribution System Pressures
- Appendix E4: Water Main Sizing
- Appendix E5: Fire Flows
- Appendix E6: Reservoir Storage
- Appendix E7: Pumping Facilities



### Performance Criteria

The following table summarizes the performance criteria used for the analysis of the Bear Gulch distribution system as detailed in the 2008 Bear Gulch Water Supply and Facilities Master Plan. Skyline and Old La Honda Systems were acquired after the development of the performance criteria, it is presumed that these criteria would be applicable.

The 2008 Bear Gulch Water Supply and Facilities Master Plan contain additional sections which provides a more detailed discussion of each criterion including relevant standards and Cal Water's established criteria, criteria used by other agencies, and the recommended values for the master plan.

Table x: Summary of Performance Criteria for Bear Gulch District

<i>Element</i>	<i>Description</i>
Supply to Distribution System	<ul style="list-style-type: none"> <li>Supply capacity sufficient to meet maximum day demand with fire flow and peak hour flow. Storage may be used to provide fire flow and peak hour flow in excess of the average maximum day demand. Per the recently adopted Waterworks standards, systems with 1000 or more service connections must be able to meet four hours of peak hourly demand with source capacity, storage capacity, and/or emergency source connections.</li> </ul>
Water Transmission Main Sizing (pipelines 18-inch or greater in diameter)	<ul style="list-style-type: none"> <li>Minimum pressures:               <ul style="list-style-type: none"> <li>50 psi for average day demand condition</li> <li>40 psi during maximum day and peak hour demand conditions</li> </ul> </li> <li>Maximum pressure: 125 psi for average day demand condition</li> <li>Maximum velocities:               <ul style="list-style-type: none"> <li>3 fps for average day demand condition</li> <li>5 fps for maximum day and peak hour demand condition</li> </ul> </li> <li>Maximum headloss:               <ul style="list-style-type: none"> <li>3 ft per 1000 ft for maximum day and peak hour demand conditions</li> </ul> </li> <li>Hazen-Williams "C" Factor = 130</li> <li>Allowable pipeline materials: ductile iron, concrete cylinder or steel</li> </ul> <p>Note: Sizing criteria are requirements for new development. Existing transmission mains are evaluated on a case-by-case basis considering age, material, velocity, headloss, and pressure.</p>

Table x: Summary of Performance Criteria for Bear Gulch District

<i>Element</i>	<i>Description</i>
Water Distribution Main Sizing (pipelines less than 18-inch in diameter)	<ul style="list-style-type: none"> <li>• Minimum pressures: <ul style="list-style-type: none"> <li>– 40 psi during peak hour demand condition</li> <li>– 20 psi residual at fire node during maximum day plus fire flow</li> </ul> </li> <li>• Maximum velocities: <ul style="list-style-type: none"> <li>– 7 fps for peak hour demand condition</li> <li>– 10 fps for maximum day demand plus fire flow</li> </ul> </li> <li>• Maximum headloss: <ul style="list-style-type: none"> <li>– 10 ft per 1000 ft for maximum day plus fire and peak hour demand conditions</li> </ul> </li> <li>• Hazen-Williams “C” Factor = 120 for ductile iron or steel; 130 for PVC</li> <li>• Allowable pipeline materials: PVC, ductile iron, or steel</li> </ul> <p>Note: Sizing criteria are requirements for new development. Existing distribution mains are evaluated on a case-by-case basis considering age, material, velocity, headloss, and pressure.</p>
Minimum Distribution Pipeline Sizes	<p>Pipes are sized to meet the minimum pressure requirements noted above or the following minimum pipe diameters, whichever is greater.</p> <ul style="list-style-type: none"> <li>• Low density residential: 12-inch on square mile grid, 8-inch on quarter mile grid, 6-inch for all other</li> <li>• Commercial: 12-inch on square mile grid; 8-inch for all other</li> <li>• Industrial: 12-inch</li> <li>• Cul-de-sac or dead-end street: 8-inch</li> <li>• Distribution to fire hydrants: 8-inch</li> </ul> <p>The maximum number of residential lots that can be served by a non-looped pipeline = 25 lots. If a non-looped line goes out-of-service, all associated residences lose water.</p>
Fire Flows	<ul style="list-style-type: none"> <li>• 2016 California Fire Code (Appendix III-A) flow rates and durations are: <ul style="list-style-type: none"> <li>– Single family (SF) residential &lt; 3600 SF = 1,000 gpm for 2 hours</li> <li>– SF residential &gt; 3600 SF and up to 11,300 SF = ranges from 1,500 gpm to 2,750 gpm for 2 hours (Fire Dept may require higher flows for larger buildings)</li> <li>– Medium density multiple family (MF) residential = 2,000 gpm for 2 hours</li> <li>– High density MF residential = 2,500 gpm for 2 hours</li> <li>– Commercial = 3,000 gpm for 3 hours</li> <li>– Industrial = 3,500 gpm for 3 hours</li> </ul> <p>Note: Flows may be reduced by up to 50% if buildings are equipped with sprinklers.</p> </li> <li>• One fire at a time in zone (no simultaneous fires in the same pressure zone).</li> </ul>

Table x: Summary of Performance Criteria for Bear Gulch District

<i>Element</i>	<i>Description</i>
Reservoir Storage	<ul style="list-style-type: none"> <li>Storage provides the following three functions: <ul style="list-style-type: none"> <li>Operational (or balancing storage) to meet daily fluctuations in demand in excess of the water supply production capacity on the maximum day. For the Bear Gulch District, this component is estimated as 25 percent of the maximum day demand.</li> <li>Fire storage to provide a reserve for firefighting. The amount varies and is estimated as the most critical (highest) fire flow required in a zone times the required duration.</li> <li>Emergency storage to provide an emergency reserve in case of planned or unplanned outages of equipment or facilities, including power or supply outages. For the Bear Gulch District, this component is estimated as one average demand day.</li> </ul> </li> <li>The total required storage is the sum of the above three components. For the Bear Gulch District, the total required storage is about 1.9 average days demand (equivalent to about 90% of the maximum demand day).</li> </ul>
Pumping Facilities	<ul style="list-style-type: none"> <li>Firm pump station capacity is with the largest pump considered to be out of service. If there are multiple pump stations serving the same service zone, only one pump is considered to be out of service for all the stations combined, i.e., not one pump at each station.</li> <li>Total pump station capacity equals the firm capacity plus a standby (out-of-service) pump equal in size to the largest pump.</li> <li>Pump stations pumping into zones with gravity reservoir storage are sized to have firm capacity equal to the maximum day zone demand (average rate over 24-hours). Fire flows are provided by gravity from the zone storage.</li> <li>Hydropneumatic pump stations are sized for firm capacity for domestic flows equal to the peak hour flow into the zone (or into the portion of the zone served by the pump station). Hydropneumatic stations must also have a fire flow capacity to provide required fire flows in the zone. Hydropneumatic stations should have back-up capabilities.</li> <li>For all zones, pump stations must also have the ability to pump any flow that must be lifted through to subsequent higher zones.</li> <li>Backup power should be provided equal to the firm capacity of the pump station by means of an on-site generator for critical stations or a plug-in portable generator for less critical stations.</li> <li></li> <li>Critical pumping facilities – a pumping facility is defined as critical if it meets any of the following criteria: <ul style="list-style-type: none"> <li>Largest facility that provides water to a particular pressure zone and/or service area.</li> <li>Facility that provides sole source of water to multiple pressure zones and/or service areas.</li> <li>Facility that provides water from a supply turnout into pressure zones and/or service areas.</li> <li>Facility that provides water from key groundwater supply wells into a pressure zone and/or service area. Key depends on capacity, quality and location of the well.</li> </ul> </li> </ul>

### Supply to Distribution System

CPUC General Order 103 requires that the quantity of water delivered to the distribution system from all source facilities be sufficient to supply adequately, dependably and safely the total requirements of all customers under maximum consumption, while meeting the pressure requirements described below. The combined flow from sources of supply and storage capacity should be adequate for four consecutive days of maximum use.

Many water agencies, particularly those with surface water supply such as the Bear Gulch District, provide supply capacity equal to the maximum day demand, and then meet peak hour needs from storage. In some cases, it may be appropriate to meet some peaking needs from the supply source, e.g.,

if there is available peaking capacity from the surface water source, or from wells in systems with groundwater supply.

The recently adopted revisions to the Waterworks Standards require that a system's water sources must have the capacity to meet the maximum day demand at all times. For systems with 1,000 or more service connections, the system must be able to meet four hours of peak hourly demand with source capacity, storage capacity, and/or emergency source connections. Both the maximum day and peak hour requirements must be met in the system as a whole and in each individual pressure zone.

For the Bear Gulch District, the criterion will be to meet maximum day demand from supply sources and peak hour demands in excess of the average maximum daily demand from storage.

#### Distribution System Pressures

Per CPUC General Order 103, the utility must maintain the following operating pressures at the service connection:

- Normal operating pressures of not less than 40 psi or more than 125 psi at the service connection;
- Minimum pressures under peak hourly seasonal demands of at least 30 psi;
- Maximum pressures under minimum hourly demand conditions of not more than 150 psi; and
- Residual pressure of 20 psi in the distribution system under fire flow conditions.

Per CPUC General Order 103, under normal operating conditions, variations in pressure are not to exceed 50 percent of the average operating pressure, determined as the arithmetical average of at least 24 hourly pressure readings.

Cal Water has established the following pressure requirements, which are used for the master plan analysis:

- Transmission Pipelines (18-inch or greater in diameter)
  - Minimum pressures:
    - 50 psi for average day demand condition
    - 40 psi during maximum day and peak hour demand conditions
  - Maximum pressures: 125 psi for average day demand condition
- Distribution Pipelines (less than 18-inch diameter)
  - Minimum pressures:
    - 40 psi during peak hour demand condition
    - 20 psi residual at fire node during maximum day plus fire flow

The recently adopted revisions to the Waterworks Standards require that each distribution system be operated in a manner to assure that the minimum operating pressure in the water main at the user service line connection is not less than 20 psi at all times throughout the distribution system. This

minimum pressure criterion applies for fire flow and other emergency conditions, such as temporary outages of pumping facilities.

The new Waterworks Standards also require that each new distribution system that expands existing service connections by 20 percent or more, or that may otherwise adversely affect distribution system pressure, must be designed to provide a minimum normal operating pressure throughout the new distribution system of not less than 40 psi at all times (excluding fire flow or other emergency conditions).

The Uniform Plumbing Code requires individual pressure reducing valves if pressures exceed 80 psi for new installations.

#### Water Main Sizing

PUC General Order 103 requires new and replacement mains be sized to accommodate the pressure requirements in the order as described above, or minimum of 6-inch diameter, whichever is larger. The transmission pipelines from sources of supply must be designed to deliver, in combination with related storage facilities and to the limits of the capacity of those sources of supply, the maximum requirements of that portion of the system dependent upon those transmission pipelines.

Cal Water requires that new pipelines be sized to meet its pressure criteria as discussed above. In addition, Cal Water has established the following additional requirements for sizing new pipelines, which are used for the master plan analysis:

- Transmission Pipelines (18-inch or greater in diameter)
  - Maximum velocities:
    - 3 feet per second (fps) for average day demand condition
    - 5 fps for maximum day and peak hour demand condition
  - Maximum headloss:
    - 3 ft per 1000 ft for maximum day and peak hour demand conditions
  - Hazen Williams “C” factor: 130
  - Allowable pipe materials: ductile iron, concrete cylinder, steel
- Distribution Pipelines (less than 18-inch in diameter)
  - Maximum velocities:
    - 7 fps for peak hour demand condition
    - 10 fps for maximum day demand plus fire flow
  - Maximum headloss:
    - 10 ft per 1000 ft for maximum day plus fire and peak hour demand conditions
  - Hazen Williams “C” factor: 120 for ductile iron or steel, 130 for PVC
  - Allowable pipe materials: PVC, ductile iron, steel
  - Minimum pipe sizes:
    - Low density residential: 12-inch on square mile grid, 8-inch on quarter mile grid, 6-inch for all other
    - Commercial: 12-inch on square mile grid
    - Industrial: 12-inch
    - Cul-de-sac or dead-end street: 8-inch
    - Distribution to fire hydrant: 8-inch
  - The maximum number of residential lots served by a non-looped pipeline is 25 lots, since all associated residences would lose water service due to a break.

The sizing criteria are requirements for new pipeline improvements and new development. Existing transmission mains are evaluated for improvement on a case-by-case basis considering age, material, velocity, headloss, and pressure. New and/or replacement pipelines should be looped to the greatest extent possible to improve hydraulics and water quality in the system.

Velocity and headloss information from the modeling analysis is used to identify hydraulic bottlenecks in the existing system and determine the best locations for hydraulic improvements. Existing pipelines that exceed the established criteria are identified, and are evaluated on a case-by-case basis. If existing pipelines must be improved, then improvements would be designed to meet the established criteria.

Many water agencies have main sizing criteria that include system pressures, as discussed above, as well as pipe velocities and headlosses. Typical velocity ranges used by other agencies are from a desirable level of 5 fps up to a maximum of 12 fps under peak hour or maximum day plus fire flow. The typical range for headlosses is from 5 feet per 1,000 feet under maximum day demand up to a maximum of 10 feet per 1,000 feet for peak hour demand. A maximum of 10 feet per 1,000 feet under any non-fire

demand condition is a typically used head loss criterion, and is equivalent to 4.3 psi pressure loss per 1,000 feet.

Typically, high velocities and/or high headlosses may manifest as a reduction in pressure. However, high velocities and corresponding high headlosses are also a concern for water hammer. According to the American Water Works Association's Manual M32 – "Distribution Network Analysis for Water Utilities" (AWWA, 1989), velocities are acceptable up to a maximum of about 10 fps to minimize such problems, while velocities of about 5 fps are desirable. Under fire flow conditions, the most likely cause of water hammer would be from rapid closure of a hydrant following use. This infrequent scenario may not warrant applying the same velocity and headloss criteria for fire flow conditions.

#### Fire Flows

PUC General Order 103 provides fire flow standards considered appropriate on an average statewide basis, but acknowledges that there are widely varying conditions for the urban, suburban and rural areas in the state. The order states that the standards prescribed by the local fire protection agency or other prevailing local governmental agency govern. Such local flow standards are to be provided whether greater or lesser than those set forth in the order, except that mains designed for and capable of providing flows in excess of the requirements set forth are to be considered mains providing excess flow for the purpose of the application of the utility's main extension rule.

The CPUC statewide fire flows are shown below for the types of land uses in the Bear Gulch District. The flows shown must be provided for up to 2 hours, in addition to the average daily demand in the area served.

<b>CPUC Statewide Average Fire Flows</b>	
<b>Type of Land Use</b>	<b>Flow (gallons per minute)</b>
Single family residential with lot density of three or more units per acre, including mobile home parks	1,000
Duplex residential units, neighborhood business of one story	1,500
Multiple residential, one and two stories; light commercial or light industrial	2,000
Multiple residential, three stories or higher; heavy commercial or heavy industrial	2,500

The Menlo Park Fire District serves the communities of Atherton, Menlo Park, East Palo Alto, and some unincorporated areas of San Mateo County in Redwood City. The Menlo Park Fire District has adopted the 2001 California Fire Code. Appendix III-A of the Fire Code contains information on required fire flows for new installations, as shown below (all flows to be provided with minimum 20 psi residual pressure):

- Single family residential and duplexes
  - Building area not exceeding 3,600 square feet (SF): 1,000 gpm for 2 hours
  - Building area greater than 3,600 SF and up to 11,300 SF: ranges from 1,500 gpm to 2,750 gpm for 2 hours. Building area from 11,301 to 20,600 SF: ranges from 3,000 to 3,750 gpm for 3 hours. Buildings larger than 20,600 SF: 4,000 gpm and higher for 4 hours. This is based on a general type of building construction using any type of allowed construction material, including wood. [Note: Requirements are lower for other building types utilizing non-combustible materials or constructed to provide a minimum of 1-hour fire resistivity. hat provide higher fire resistivity. For these other building

types, the minimum fire flow is 1,500 gpm for 2 hours for buildings up to 12,700 SF. Higher flows are required for larger buildings.]

- Medium density multiple family residential – 2,000 gpm for 2 hours
- High density multiple family residential and schools – 2,500 gpm for 2 hours
- Commercial – 3,000 gpm for 3 hours
- Industrial – 3,500 gpm for 3 hours

If the buildings have approved automatic sprinkler systems, the Menlo Park Fire District may reduce the required flow amount by up to 50 percent on a case-by-case basis.

The Old La Honda Fire Protection District (Old La Honda Fire District) serves the remainder of the Bear Gulch District, including the Town of Old La Honda, the Town of Portola Valley and several unincorporated areas such as Ladera, Los Trancos Woods, Vista Verde, Emerald Lake, and the Skyline Area. The current fire flow requirements of the Old La Honda Fire Protection District are an amended version of the California Fire Code, as shown below (flows to be provided with minimum 20 psi residual pressure):

- One and Two Family Dwellings: 1,000 gpm minimum. This flow may be reduced by 50% if the building has an approved automatic sprinkler system. A water supply for fire protection means a fire hydrant within 500 feet from the building capable of the required fire flow; or an approved storage facility at the structure with a minimum of 18,000 gallons of water for fire protection with a hydrant capable of delivering 1,000 gpm from storage.
- Land Divisions and Subdivisions: 1,000 gpm minimum flow. This flow may be reduced by 50% if the building has an approved automatic sprinkler system. Hydrants must be 500 feet apart within 500 feet from structures. Hydrants must meet required flow for a minimum 120,000 gallons in storage for fire protection.

The Old La Honda Fire Protection serves the western portion of the Fire District with steep terrain in the wildland/urban interface that is subject to urban wildfire threats. Their service area includes rural areas with private (individual) water system, (i.e., not served by Cal Water or municipal water agencies). The current fire protection requirements established by the Fire District are not as stringent as the California Fire Code, since the California Fire Code was not considered practical due to the lack of existing municipal water systems and the rural nature of the area.

The Town of Old La Honda has conducted recent studies regarding the need for improved fire protection, and prepared a Fire Management Plan. The town does not agree with the reduced requirements adopted by the Fire District, or allowing small individual storage facilities to function as the fire protection supply.

The California Fire Code was used as the baseline for evaluating the distribution system for fire flows, which in some cases are more stringent than current Fire Department criteria, e.g., Old La Honda Fire Protection area. Under CPUC rules, facilities to meet fire flow requirements for individual customers are the responsibility of those they are designed to serve. Cal Water's understanding is that the local supply system is only charged with meeting 3,500 gpm for insurance rating purposes. If fire flow exceeds 3,500

gpm and cannot be met by the local water system, the property owner either provides additional on-site fire protection or pays a higher premium.

Water system planning analyses typically assume that only one fire will occur at a time within a pressure zone or service subarea. If the pressure zone or service subarea is very large, two simultaneous fires may be simulated. For the Bear Gulch District, it is assumed that only one fire would occur at a time in a zone.

#### Reservoir Storage

PUC General Order 103 does not contain any specific requirements regarding storage amounts, but rather requires the provision of service over a defined period under specified conditions. The combined flow from sources of supply and storage capacity must be adequate for four consecutive days of maximum use.

Water system storage is typically sized based on the following three components:

- operational storage (also called equalizing or balancing storage);
- fire reserve storage; and,
- emergency storage.

Water storage capacity may also be provided in equivalent ways, other than tanks. For example, some agencies provide backup generators at pump stations to provide some of the reliable emergency supply. In some cases, a water system may be able to peak off the supply source, which can reduce the in-system operational storage requirement. Water systems with groundwater supply may use wells with backup power to provide some or all of these components.

Operational (equalizing or balancing) storage is the volume of water required to meet daily fluctuations in demand in excess of the water supply production capacity on the maximum day. This storage volume is determined by the variation in the hourly demand during the day of maximum demand. When supply capacity is provided to meet the maximum day demand, operational storage requirements typically range from 25 to 50 percent of the maximum day demand. If peaking capacity is available from the supply system, then the operational storage requirement may be lower. For the Bear Gulch District, operational storage at 25 percent of the maximum day demand is recommended, which is a typical industry standard. This criterion is based on the Bear Gulch diurnal curve pattern that was developed for the hydraulic model from system-specific information and complies with the new Waterworks Standard requirement to be able to meet 4 hours of peak hourly demand from a combination of supply sources and storage (maximum day is provided from supply sources and the peak hourly demand in excess of the average hourly on the maximum day is met from storage).

Fire reserve storage is the amount of storage volume necessary to supply fire flow for the most critical land use within a pressure zone. The fire reserve storage is typically computed for each pressure zone or service area, based on the most restrictive (highest) fire flow requirement times the duration for which it must be supplied. The fire reserve storage should always be available for fire protection to every part of the distribution system.

Emergency storage is the volume of water required to supply the service area during planned or unplanned equipment outages, power outages, or well shutdowns for unexpected mechanical

difficulties or quality issues. This storage needs to be sufficient to provide a reasonable level of uninterrupted service under such circumstances. The minimum recommended emergency storage generally represents a 6-hour power outage on the maximum demand day (25 percent of maximum day demand). A typical assumption for emergency storage in the Bay Area is that there may be a supply outage and/or power outage for 8 to 12 hours on the maximum demand day, which would represent about 35 to 50 percent of the maximum day demand. An outage of this duration on the maximum demand day would be equivalent to requiring emergency storage equal to about 0.7 to 1.0 average demand day. For the Bear Gulch District, one average day demand of emergency storage has been used, which is consistent with the criteria for other Cal Water service areas on the San Mateo Peninsula.

The storage criteria for the Bear Gulch District are summarized below. Total storage equals the sum of the operational storage, emergency storage, and fire reserve.

<b><i>Reservoir Storage Criteria for Bear Gulch District</i></b>	
<b><i>Storage Component</i></b>	<b><i>Criterion</i></b>
Operational Storage (also called equalizing or balancing storage)	25 percent of maximum day demand
Emergency Storage	One average day demand
Fire Reserve	For each zone, based on most critical land use within zone and required fire flow amount and duration.
TOTAL REQUIRED STORAGE	Sum of all three components

The storage criteria identified above do not include additional storage capacity that may be required to allow time-of-use pumping. With time-of-use pumping, reservoir storage is needed to store the water for use during the “pumps off” period. This is discussed further below under pumping facilities.

If standby power is provided at pump stations that supply a zone that would avoid potential service interruptions, this could also be considered as an alternative to emergency storage. This option is sometimes more feasible than storage tanks, particularly for small zones.

The storage analysis also considers minimizing water quality impacts, such as potential for nitrification, at storage reservoirs due to low turnover during low demand periods. Water age is a general indicator for other water quality problems, such as loss of disinfectant residual, or potential for nitrification. Water age in reservoirs is often used to identify reservoirs with potential problems, i.e., higher water age typically means lower turnover and potential for water quality problems. The recently adopted revisions to the Waterworks Standards require that tanks must be constructed with a separate inlet and outlet (internal or external) to improve turnover for water quality purposes.

#### [Pumping Facilities](#)

PUC General Order 103 does not contain any specific requirements regarding pumping capacities. The transmission system from sources of supply must be designed to deliver, in combination with related storage facilities and to the limits of the capacity of those sources of supply, the maximum requirements of that portion of the system dependent upon those transmission pipelines.

Cal Water has established the following criteria for pumping capacities:

- Zones with reservoir storage should provide firm pumping capacity or gravity supply capacity that is sufficient to meet maximum day demand. For zones with storage, fire reserves are provided from storage.
- Zones without storage in the zone should have firm pumping capacity or gravity supply capacity to meet the peak hour demand on the maximum day, plus a fire pump or other means of providing fire flows to the zone.
- For all zones, the pump station must also have the ability to pump any flow that would be lifted through to supply subsequent higher zones.
- Firm capacity is defined as the capacity with the largest pumping unit at the pump station out of service.

Some agencies size pumps to allow time of use pumping to reduce energy costs. For example, pump stations may be sized for 150 percent of the maximum day demand. This sizing allows for operating the pump station during a 16-hour period, and keeping the pumps off for 8 hours during the day (6-hour peak energy cost period plus an hour on either end as an operational cushion). With time-of-use pumping, reservoir storage is needed to store the water for use during the “pumps off” period. Depending on the amount of capital improvements needed to provide the additional booster capacity, additional storage capacity, and/or additional supply peaking capacity needed to allow off-peak pumping, it may not be cost effective relative to the annual savings that might be realized from lower pumping costs.

Backup power should be provided equal to the firm capacity of the pump station by means of an on-site generator for critical stations or a plug-in portable generator for less critical stations. Critical pumping facilities are those that meet any one or more of the following criteria: 1) largest facility that provides water to a particular pressure zone and/or service area; 2) facility that provides the sole source of water to multiple pressure zones and/or service areas; 3) facility that provides water from a supply turnout into pressure zones and/or service areas; and/or 4) facility that provides water from key (depend on capacity, quality, location) groundwater supply wells into a pressure zone and/or service area.

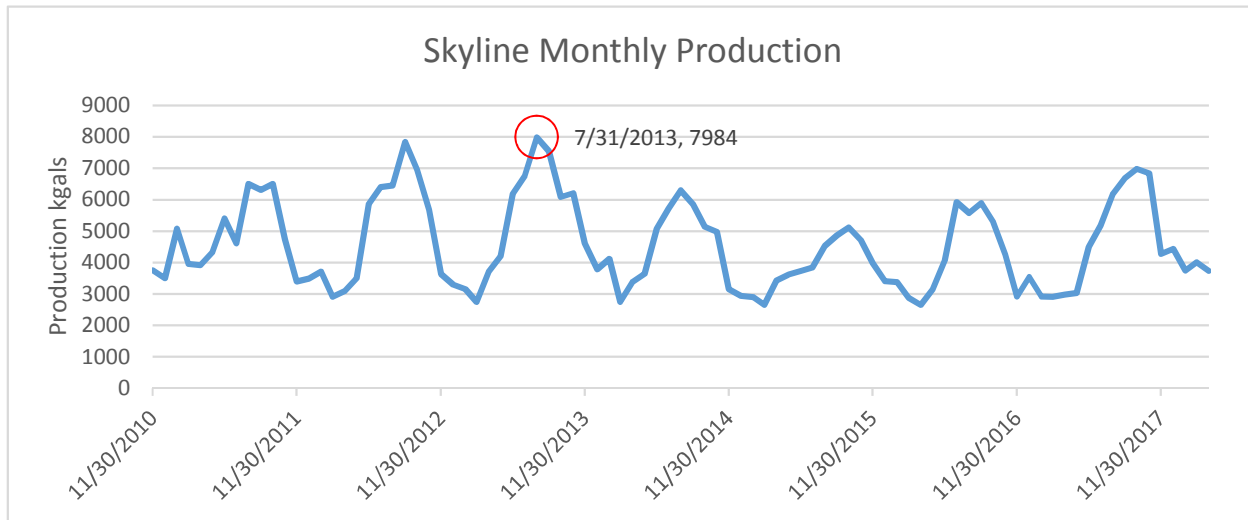


## Appendix F: Storage Capacity Evaluation

- Appendix F1: Skyline System Storage Capacity Evaluation
- Appendix F2: Old La Honda System Storage Capacity Evaluation



## Appendix F1: Skyline Storage Calculation



Max Month 2010 to present (July 2013) = 7,984,000 gals  
 ADD (Avg day of max month) = 266,133 gal/day  
 MDD = ADD \* 1.5 = 399,200 gal/day

Operational Storage (4 hrs of PHD):

$(\text{MDD}/1440) * (1.5) * (4 \text{ hrs}) * (60 \text{ min/hr}) = 99,800 \text{ gals}$

Emergency Storage:

3 days \* ADD = 798,400 gals

Fire Storage:

Fire Flow = 1,500 gpm \* 2 hrs = 180,000 gals

Total Storage Required for Skyline System:

Operation + Emergency + Fire = 1,078,200 gals

Total Existing Storage:

Station 41 = 380,000 gals

Station 42 = 250,000 gals

Total = 630,000 gals

Total Storage Deficit:

Additional Storage Required for Skyline = 448,200 gals



## Appendix F2: Old La Honda Storage Calculation

Max Month 2010 to present (July 2013) =	n/a	gals	
ADD =	24,000	gal/day	10-yr max
MDD =	36,000	gal/day	BG MDD

Operational Storage (4 hrs of PHD):

$$(MDD/1440) * (1.5) * (4 \text{ hrs}) * (60 \text{ min/hr}) = 9,000 \text{ gals}$$

Emergency Storage:

$$3 \text{ days} * ADD = 72,000 \text{ gals}$$

Fire Storage:

$$\text{Fire Flow} = 1,500 \text{ gpm} * 2 \text{ hrs} = 180,000 \text{ gals}$$

Total Storage Required for Skyline System:

$$\text{Operation} + \text{Emergency} + \text{Fire} = 261,000 \text{ gals}$$

Total Existing Storage:

$$\text{Station 46} = 128,000 \text{ gals}$$

$$\text{Station 47} = 160,000 \text{ gals}$$

$$\text{Total} = 288,000 \text{ gals}$$

Total Storage Deficit:

$$\text{Additional Storage Required for Skyline} = (27,000) \text{ gals}$$



## Appendix G: Pumping Capacity Evaluation - Gap (Zone) Analysis

- Appendix G1: Skyline System Pumping Capacity Evaluation - Gap (Zone) Analysis
- Appendix G2: Old La Honda System Pumping Capacity Evaluation - Gap (Zone) Analysis



Appendix G1: Skyline System Gap Analysis (1 of 5)

Max MDD from last 10 years (2009-2018) mgd = 0.398					Facility Capacity Summary					
Supply Zone	Dependent Zone	Maximum Day Demand (MGD)	Peak Hour Demand (GPM)	Peak Hour Demand (MGD)						
					MDD Supply Facilities	MDD Supply (GPM)	PHD Supply Facilities	PHD Supply (GPM)	Storage Facilities	Storage Capacity (MG)
System	All	0.398	415	0.597	040-A 040-B	280 280	040-A 040-B	280 280	041-T1 041-T2 042-T1 042-T2	0.189 0.192 0.060 0.060
	Subtotal	0.398	415	0.597		280		280		0.501
2370	cascade from 2370 w/o 1610 cascade	0.249	259	0.373	040-A 040-B	280 280	040-A 040-B	280 280	041-T1 041-T2	0.189 0.192
	Subtotal	0.30	259	0.373		280		280		0.381
1610	1343, 1426, 1205	0.149	155	0.224					042-T1 042-T2	0.060 0.060
	Subtotal	0.15	155	0.224		0		0		0.120

Appendix G1: Skyline System Gap Analysis (2 of 5)

Operational Supply								
Supply Zone	Dependent Zone	Pumping	Pumping	Storage				Deficient in Operational Supply?
		MDD Surplus or Deficiency (GPM)	PHD Surplus or Deficiency (GPM)	4hrsxPHD(def) Required (Gal)	Ex. Storage Capacity (Gal)	Emergency Connection	Net Surplus or Deficiency (Gal)	
System	All							
	Subtotal	280	(135)	32,300	501,000		468,700	No
2370	cascade from 2370 w/o 1610 cascade							
	Subtotal	-	21	0	381,000		381,000	No
1610	1343, 1426, 1205							
	Subtotal	-	(155)	37,313	120,000		82,688	No

Appendix G1: Skyline System Gap Analysis (3 of 5)

Max ADD from last 10 years (2009-2018) mgd = 0.17							
Supply Zone	Cascade Zones	Average Day Demand (GPM)	Average Day Demand (MGD)	Facility Capacity Summary			
				PHD Supply Facilities	PHD Supply (GPM)	Gen Set Installation (No = 0, Yes = 1)	Supply during Power Outage (GPM)
System	All		0.173	040-A 040-B	280 280	1 1	280 280
	Subtotal	120	0.173			0	560
2370	cascade from 2370 w/o 1610 cascade		0.106				
	Subtotal	73	0.106			0	0
1610	1343, 1426, 1205		0.067				
	Subtotal	47	0.067			0	0

Appendix G1: Skyline System Gap Analysis (4 of 5)

Supply Zone	Cascade Zones	Fire Flow Supply						
		Confirm FF Requirement			Pumping	Storage		
		Fire Flow Requirement (GPM)	Fire Flow Requirement (Hrs)	Fire Flow Requirement (Gal)	Surplus or Deficiency (GPM)	Hrs x Pump(Def) Required (Gal)	Net Surplus or Deficiency (Gal)	Deficient in Fire Flow Supply?
System	all							
	Subtotal	1500	2	180,000	(1,220)	146,400	354,600	No
2370	cascade from 2370 w/o 1610 cascade							
	Subtotal	1500	2	180,000	(1,500)	180,000	201,000	No
1610	1343, 1426, 1205							
	Subtotal	1500	2	180,000	(1,500)	180,000	(60,000)	Yes

Appendix G1: Skyline System Gap Analysis (5 of 5)

Supply Zone	Cascade Zones	Emergency Supply					
		3					
		ADD		Pumping	Storage		
		Emergency Supply Requirement (GPM)	Emergency Supply Requirement (Gal)	Surplus or Deficiency (GPM)	Hrs x Pump(Def) Required (Gal)	Net Surplus or Deficiency (Gal)	Deficient in Emergency Supply?
System	all						
	Subtotal	360.417	519,000	200	0	501,000	No
2370	cascade from 2370 w/o 1610 cascade						
	Subtotal	219.854	316,590	(220)	316,590	64,410	No
1610	1343, 1426, 1205						
	Subtotal	140.563	202,410	(141)	202,410	(82,410)	Yes

Appendix G2: Old La Honda System Gap Analysis (1 of 5)

Max MDD from last 10 years (2009-2018) mgd = 0.041					Facility Capacity Summary					
Supply Zone	Dependent Zone	Maximum Day Demand (MGD)	Peak Hour Demand (GPM)	Peak Hour Demand (MGD)						
					MDD Supply Facilities	MDD Supply (GPM)	PHD Supply Facilities	PHD Supply (GPM)	Storage Facilities	Storage Capacity (MG)
System	All	0.041	43	0.062	046-A 046-B 047-A 047-B	100 75 26 26	046-A 046-B 047-A 047-B	100 75 26 26	046-T1 046-T2 047-T1 047-T2	0.064 0.064 0.080 0.080
	Subtotal	0.041	43	0.062		127		127		0.29
1255		0.018	18	0.027	046-A 046-B	100 75	046-A 046-B	100 75	046-T1 046-T2	0.064 0.064
	Subtotal	0.03	18	0.027		75		75		0.13
1810		0.023	24	0.035	047-A 047-B	26 26	047-A 047-B	26 26	047-T1 047-T2	0.080 0.080
	Subtotal	0.02	24	0.03		26		26		0.16

Appendix G2: Old La Honda System Gap Analysis (2 of 5)

Operational Supply								
Supply Zone	Dependent Zone	Pumping	Pumping	Storage				Deficient in Operational Supply?
		MDD Surplus or Deficiency (GPM)	PHD Surplus or Deficiency (GPM)	4hrsxPHD(def) Required (Gal)	Ex. Storage Capacity (Gal)	Emergency Connection	Net Surplus or Deficiency (Gal)	
System	All							
	Subtotal	99	84	0	288,000		288,000	No
1255								
	Subtotal	54	57	0	128,000		128,000	No
1810								
	Subtotal	10	2	0	160,000		160,000	No

Appendix G2: Old La Honda System Gap Analysis (3 of 5)

Max ADD from last 10 years (2009-2018) mgd = 0.02							
Supply Zone	Cascade Zones	Average Day Demand (GPM)	Average Day Demand (MGD)	Facility Capacity Summary			
				PHD Supply Facilities	PHD Supply (GPM)	Gen Set Installation (No = 0, Yes = 1)	Supply during Power Outage (GPM)
System	All		0.024	046-A 046-B 047-A 047-B	100 75 26 26	1 1 1 1	100 75 26 26
	Subtotal	17	0.024		227.00		227
1255			0.010	046-A 046-B	100 75	1 1	100 75
	Subtotal	7	0.010		175.00		175
1810			0.014	047-A 047-B	26 26	1 1	26 26
	Subtotal	9	0.014		52.00		227

Appendix G2: Old La Honda System Gap Analysis (4 of 5)

Supply Zone	Cascade Zones	Fire Flow Supply						
		Confirm FF Requirement			Pumping	Storage		
		Fire Flow Requirement (GPM)	Fire Flow Requirement (Hrs)	Fire Flow Requirement (Gal)	Surplus or Deficiency (GPM)	Hrs x Pump(Def) Required (Gal)	Net Surplus or Deficiency (Gal)	Deficient in Fire Flow Supply?
System	All							
	Subtotal	1500	2	180,000	(1,401)	168,177	119,823	No
1255								
	Subtotal	1500	2	180,000	(1,446)	173,563	(45,563)	Yes
1810								
	Subtotal	1500	2	180,000	(1,490)	178,817	(18,817)	Yes

Appendix G2: Old La Honda System Gap Analysis (5 of 5)

Supply Zone	Cascade Zones	Emergency Supply					
		3					
		ADD		Pumping	Storage		
		Emergency Supply Requirement (GPM)	Emergency Supply Requirement (Gal)	Surplus or Deficiency (GPM)	Hrs x Pump(Def) Required (Gal)	Net Surplus or Deficiency (Gal)	Deficient in Emergency Supply?
System	All						
	Subtotal	50.000	72,000	177	0	288,000	No
1255							
	Subtotal	21.650	31,176	153	0	128,000	No
1810							
	Subtotal	28.350	40,824	199	0	160,000	No